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THE

ROTHAMSTED MEMOIRS

ON

AGRICULTURAL CHEMISTRY

AND

PHYSIOLOGY.

BY

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AND

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&c., &c.

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ROTHAMSTED MEMOIRS.

CONTENTS OF VOL. IV.

REPORTS OF EXPERIMENTS ON THE FEEDING OF ANIMALS, SEWAGE UTILISATION, ENSILAGE, &c., &c.

E CHEMISTRY OF THE FEEDING OF ANIMALS FOR THE PRODUCTION OF MEAT AND MANURE.

LECTURE DELIVERED BEFORE THE ROYAL DUBLIN SOCIETY, MARCH 31, 1864.

BY JOHN BENNET LAWES, F.R.S., F.C.S.

ing and feeding of stock must always ı important branch of the agricultural is Island. With a climate rarely so hot mmer, or so cold in winter, as to mate- vegetation, Ireland may not less truly ly be styled the Emerald Isle. A suc- sons more than usually unfavourable for s greatly reduced the profits, and even the ıy of your farmers. It is natural, there- re should be, at the present time, more cted to the production of meat, and less of corn; more especially as with the de- of grain that of meat has considerably ıd has probably not yet reached its .

he application of science to agriculture ly regarded with much favour by prac- there are still very many who feel how it would be to know more of the ra- ir operations than they do at present. : principles involved even in old-estab- s are frequently but little understood; ; is every year becoming less and less utine business than it was formerly: w manures, improved descriptions of d, and new mechanical appliances are ing introduced, requiring more know- rimination in their selection and use.
lar branch of agriculture upon which I our to address you this evening is that ion of *meat* and *manure*.

that when fattening animals are supplied nt amount of proper food they increase in ion of the food being fixed or stored up in t other portions are rejected by the ani- id and solid form, and serve as manure; s are expended or lost in the processes and cutaneous exhalation. Experience s that some foods have higher feeding hers, and it is generally supposed that ace in feeding properties *there will also e in the value of the manure.*

It is the province of agricultural chemistry to determine what proportion of the several constituents of the food consumed will be stored up in the form of meat, and how much will remain as manure, according to the description of animal, and the kind of food employed; and so to provide the means of estimating the value of the respective products of the feeding operation. To this end, it is necessary to determine, by means of careful analysis, the composition of the foods consumed, of animals in the store or lean and in the fat condition, and of the manurial matters voided. Such an undertaking is, however, by no means a light one, and it can only be carried out with any prospect of success by the conjoint aid of experiments on a large scale in the feeding-shed, and of investigations in the laboratory, involving a great amount of analytical labour, and requiring the observance of all the refinements of method which modern science permits.

I propose to bring before you a condensed summary of some of the results which have been obtained in experiments made at different times during the last twenty years, at my farm and laboratory, at Rothamsted, in Hertfordshire. There are, it is true, many points which are not as yet satisfactorily cleared up, and some of these are still under investigation. The figures given in the tables, in most cases, however, represent the results obtained in careful experiments with large numbers of animals of each of the descriptions indicated, and they may be taken as showing what should be the average result obtained in ordinary farm practice, when animals of fair quality are fed liberally for the butcher.

Composition of Oxen, Sheep, and Pigs, in the Store and Fat Condition.

For the purposes of my illustration, I shall assume that an ox or a sheep will increase in weight by about one-half, and that a pig will double its weight during the so-called fattening period. Accordingly, I shall direct your attention to the composition of each of these descriptions of animal when in the lean or stor

ity, or stinted in amount.
…minary remarks, I will now direct …the tables.

…sition, per cent., of Oxen, Sheep, and …store, and in the fat condition.

	Oxen.		Sheep.		Pigs.	
	Store	Fat.	Store	Fat.	Store	Fat.
e	16.0	16.0	15.0	12.5	14.0	10.5
stance	16.0	20.0	18.0	33.0	22.0	44.0
....	5.2	4.0	3.5	3.0	2.8	1.8
ce ...	39.3	49.0	36.5	46.5	36.8	56.8
....	60.8	51.0	63.5	51.5	67.2	42.7
. ...	100.0	100.0	100.0	100.0	100.0	100.0

…the composition, per cent., of oxen, …th in the store and in the fat con…sents given being the nitrogenous … the non-nitrogenous substance or … incombustible matter, the sum of …substance, and the water.

… nitrogenous substance, it is seen …ription of animal there are seve… of it in the fat than in the store … on the other hand, there is in the …xen and the sheep nearly, and in …, twice as much in 100 lbs. live …s in the same weight of the store

is generally attributable to the character of t… and is found to result when too much oily … given, or when pigs are fed freely with roots … succulent food.

Proportion of Parts, in Animals of different … tions, and in different Conditions of Matu…

Passing from the question of the chemical …sition of oxen, sheep, and pigs, it will be d… before considering the relation of the incre… manure produced to that of the food co… briefly to point out some characteristic diffe… structure or relative proportion of certain … internal organs, as in these will be found the k… difference in the character and amount of foo… the three descriptions of animal respectively… Table II. illustrates this part of the subject.

Table II.—*Relation of Parts in Animals of … Descriptions, and in different Conditions of M…*

	Per Cent.				
	In different animals.			In Shee… rent co…	
	Oxen.	Sheep.	Pigs.	Store.	…
Average of	36	249	50	5	1…
Stomachs and contents	11.8	7.5	1.3	6.1	…

sheep contains only 7½, and that of the be. Of intestines and contents, on the ne ox contains only 2¾, the sheep 3½, and er cent. Again, of stomachs and intesuir respective contents) taken together, ains about 14¼, sheep about 11, and cent. Thus, of the receptacles and ories of the food, the oxen contain gest, and pigs by far the smallest proh would appear to indicate a great differquirement for bulk of food, such, indeed, reality exists. Oxen require a larger proody fibre in their food than sheep, and more than pigs. On the other hand, the ig contains much more starch, or allied tter, than that of sheep, and that of sheep at of oxen, reckoned in relation to the e animal; and it is known that starch s primary change (into sugar) almost e length of the intestinal canal. Accordserve that the pig has a larger proportion than the sheep, and the sheep more than

urther elaborating, or what we may ed labour organs of the body, and their eart, liver, lungs, blood, &c.—the prom to be nearly the same in the three desnimal.

ortion of internal or loose fat is greater than in the oxen; but it should be oba large proportion of the sheep contrie average result given in the table were vanced state of fatness than the oxen. atively small proportion of internal fat accounted for by the peculiarities of the e proportion of its internal organs is y small, and its speciality is to lay on er proportion outside the frame.

l portion of the table shows the varying the different parts in one and the same animal, according to its degree of maanimals selected for illustration of this eep. Records not given in the table s the animals grew and fattened, the , per head, of stomachs and contents iderably; that the intestines and cona much less degree; that the internal loose fat was more than trebled; and that the other internal parts, and their fluids, collectively, increased in nearly the same proportion as the stomachs and contents. The general result was, that the total offal parts increased in actual amount from the store to the very fat condition in the proportion of about 1 to 1⅖; but the total carcass parts augmented from 1 to nearly 2½—much more, therefore, than the total offal parts.

Turning now to the figures in the table, it is seen that the per cent., or proportion in 100 parts, of all the internal organs and parts, excepting the loose fat, diminished very considerably as the animals matured and fattened. Whilst the total offal parts diminished from 45.2 in the store, to 40.6 in the fat, and to 35.5 per cent. in the very fat condition, the carcass parts increased from 53.4 in the store, to 58.7 in the fat, and to 64.1 per cent. in the very fat condition. That is to say, the so-called offal parts, which are chiefly composed of the organs of reception, elaboration, and transmission of the food constituents, increase in very much less proportion than those parts which it is the object of the feeder should be produced from the food consumed.

Relation of the Increase, Manure, and Loss by Respiration, to the Food consumed, by different Animals.

We now come to the question of the description and amount of food consumed by the different animals to produce a given amount of increase, and to the collateral questions of the relation of the constituents in the increase and in the manure to those in the food consumed.

Table III. shows the amounts of certain foods assumed to be required for the production of 100 lbs. of increase in live weight—of oxen, sheep, and pigs, respectively. The amounts will, of course, vary, according to the quality of the animal, the stage of its development, the external conditions to which it is subjected, the description and quality of the food, and so on; but the quantities assumed are approximately those which will be required, taking the average of large numbers of animals over the whole period of fattening, and supposing foods of the descriptions indicated, and of good quality, are employed, and that other conditions are moderately favourable.

TABLE III.

E III.—*Food, Increase, Manure, &c., of Fattening Animals.*

OXEN.

250 lbs. Oil-cake, 600 lbs. Clover Chaff, 3,500 lbs. Swedes } Produce 100 lbs. Increase, and Supply—				100 Total Dry Substance of Food supply—			Amount of each constituent stored up, for 100 of it consumed.
In Food.	In 100 lbs. Increase.	In Manure.	To Respiration, &c.	In Increase.	In Manure.	To Respiration, &c	
lbs.	lbs.	lbs.	lbs.				
218	9.0	323.0	636	0.8	29.1	57.3	4.1
808	58.0			5.2			7.2
83	1.6	81.4	—	0.2	7.4	—	1.9
1109	68.6	404.4	636	6.2	36.5	57.3	

SHEEP.

250 lbs. Oil-cake, 300 lbs. Clover Chaff, 4,000 lbs. Swedes } Produce 100 lbs. Increase, and Supply—				100 Total Dry Substance of Food Supply—			Amount of each constituent stored up, for 100 of it consumed.
In Food.	In 100 lbs. Increase.	In Manure.	To Respiration, &c.	In Increase.	In Manure.	To Respiration, &c.	
lbs.	lbs.	lbs.	lbs.				
177	7.5	229	548.5	0.8	25.1	60.1	4.2
671	63.0			7.0			9.4
64	2.0	62	—	0.2	6.8	—	3.1
912	72.5	291	548.5	8.0	31.9	60.1	

PIGS.

500 lbs. Barley meal produce 100 lbs. Increase, and Supply—				100 Total Dry Substance of Food Supply—			Amount of each constituent stor'd up, for 100 of it consumed.
In Food.	In 100 lbs. Increase.	In Manure.	To Respiration, &c.	In Increase.	In Manure.	To Respiration, &c.	
lbs.	lbs.	lbs.	lbs.				
52	7.0	59.8	276.2	1.7	14.3	65.7	13.5
357	66.0			15.7			18.5
11	0.8	10.2	—	0.2	2.4	—	7.3
420	73.8	70.0	276.2	17.6	16.7	65.7	

ferent foods recorded in
after a very careful con-
umerous experiments on
nd after the illustrations
e different proportions of
escriptions of animal, it
re the variations in the
ood recorded as required
hus, to produce the same

amount of increase, oxen consume a much larger proportion of hay, containing so much indigestible matter, than sheep; whilst pigs are fattened on a diet as concentrated and containing as little indigestible substance as corn alone. The actual amounts of food assumed to be required for the production of 100 lbs. increase in live weight are—for oxen, 250 lbs. of oil-cake, 600 lbs. of hay-chaff, and 3,500 lbs. of swedes; for sheep, 250 lbs. of oil-cake, 300 lbs. of hay-chaff,

and 4,000 lbs. of swedes; and for pigs, 500 lbs. of barley meal.

It will be remembered that when speaking of the composition of the animals themselves, their constituents were grouped under the heads of nitrogenous substance, non-nitrogenous substance, mineral matter, and total dry substance, and the same classification is, for convenience of comparison, adopted in reference to the composition of the food, increase, and manure, of the different animals as recorded in Table III.

As the food of the pig is the most simple, I will direct your attention to the figures relating to it in the first place. These will be found in the lowest division of the table.

The 500 lbs. of barley meal consumed in increasing the weight of the pig from 100 to 200 lbs. contains 420 lbs. of dry substance, and the 100 lbs. increase in live weight produced by it not quite 74 lbs.; about 70 lbs. remain in the manure, and 276 out of the 420 lbs. consumed are expended in respiration, and other exhalations from the body. Nearly two-thirds of the whole dry substance consumed have, therefore, been expended in keeping in working order the living meat and manure-making machine.

Looking to the column showing the composition of the 100 lbs. of increase, it is seen that it contains only 7 lbs. of nitrogenous substance, and 66 lbs., or more than 9 times as much non-nitrogenous substance or fat, whilst the mineral matter does not amount to 1 per cent. The general result is, then, that nearly two-thirds of the fattening increase in live weight were pure fat itself, and only about one-fourteenth of it nitrogenous substance or lean meat.

But to produce the 7 lbs. of nitrogenous substance in increase, 52 lbs. were consumed in food; by far the greater part of the remainder being found in the manure. To produce the 66 lbs. of fat, 357 lbs. of non-nitrogenous substance were consumed; but as it existed in the food almost entirely in the form of starch, and as it requires about 2½ parts of starch to form 1 of fat, it may be said that at least 165 lbs. of the non-nitrogenous substance consumed contributed pretty directly to the formation of the 66 lbs. of fat. Lastly in reference to the increase: of the 11 lbs. of mineral matter consumed, only about ¾ lb. were stored up in the increase of the animal.

It is observed, then, that a comparatively small proportion of either the nitrogenous substance, or the mineral matter of the food, is retained in the increase; the manure, on the other hand, retains a very large proportion of the former, and nearly the whole of the latter.

Of 100 parts of gross dry substance consumed, 1.7 parts of nitrogenous substance, *15.7 of fat*, and 0 2 *of mineral matter—in all 17.6 parts—are stored up in the increase; 14.3 parts, consisting of* highly nitrogenous organic matter, and 2.4 parts o matter, making a total of 16.7 parts, are the manure; and 65.7 parts, consisting chie bon, hydrogen, and oxygen, are lost by r &c. Or, if we reckon the proportion of ea constituents consumed, which is stored up crease, the last column of the table shows t of nitrogenous substance consumed, 13.5 pa non-nitrogenous substance consumed, 18.5 of 100 mineral matter consumed, 7.3 pa tained in the increase.

It will not be necessary to follow so c figures in the table relating to the sheep It will suffice to direct attention to the c rences of result obtained with the three desc animal.

Whilst the pig required only 420 lbs., th quired 912 lbs., and the oxen 1,109 lbs. of dry in food to produce 100 lbs. increase in live other words, the sheep consumed more tha much, and the oxen more than two and a as much, to produce a given amount of incre pig. But the food of the pig was of a much b racter than that of the other animals. Wh sisted entirely of highly elaborated grain, sembling human food, the food of the oth contained a large amount both of woody fi crude succulent roots; that of the ox cont largest proportion of hay, with its high per indigestible woody matter.

Turning to the columns giving the com 100 parts of the increase, they show that of the pig contained 73.8 parts of dry that of the sheep contained rather less, a the oxen rather less still. The proportion was greater in the increase of the pig tha of sheep, and greater in that of the shee that of the oxen. The contrary was, ho case with the proportion of nitrogenous which was the greatest (9 per cent.) in th of the oxen, less (7.5 per cent.) in that and less still (7 per cent.) in that of pig be observed, too, that the per centage o matter in the increase of the ox and she siderably higher than in that of the pig even rather higher in the case of sheep t Independently of any essential differences ture in the different animals, this result due to the fact that sheep and oxen, especi develope bony structure during the fatteni more than pigs. It is true that both sheep are, compared with oxen, fattened at stage of their development; but not only more naturally disposed to fatten instead frame very early in his career, if only plied with proper food, but the pract

e last column of the table shows that ogenous substance of food consumed, d sheep stored up little more than 4, about 13.5 parts; that for 100 non- substance in food, the oxen yielded 7.2,).4, and the pigs 18.5 parts of fat in d that for 100 mineral matter con- oxen stored up 1.9, the sheep 3.1, and parts.

ry much larger proportion of the con- the food of the pig than of that of oxen ould be stored up as increase is, how- hat we should expect, when we consider mer consists of matured grain, and the r of comparatively immatured vegetable taining a large proportion of indigestible r, and also a larger amount of nitroge- neral matter in proportion to its diges- ilable non-nitrogenous constituents.

t the pig, with his much higher character e so much more increase than the sheep amount consumed, and the sheep more , the ox returned as manure 36.5 per dry substance he consumed, the sheep d the pig only 16.7 per cent. The pro- he consumed matter that was lost by ras, on the other hand, rather the lowest , namely, 57.3 per cent.; whilst with the 60.1, and with the pig it was 65.7 per

The first column of this table shows that w pig increases from 6 to 6½ per cent. of its w week, the sheep increases only 1¾, and the more than 1 per cent. No wonder, then (t thing of the difference in the character of t that the oxen and sheep, requiring so muc time to add a given proportion to the weigh bodies, should consume so much more food much more as manure, and expend so muc respiration, for a given amount of increase p as we have seen they do.

The other columns of the table show, howe neither the amount of dry substance of food c nor the amount lost by respiration, by a give of animal within a given time, is in excess pig in anything like the proportion that its exceeds that of the other animals. In othe the much higher character of the food of the p itself in the much greater rapidity, and t greater proportion, of its conversion into m most valuable product of the feeding operati

Lastly, in regard to the results in this ta remarkable that, whilst, for a given weight of within a given time, the amounts of increas and of dry substance consumed in food, and lo piration, are so very different for the different the amounts of dry substance voided in ex are almost identical. I shall show further the limit of consumption is much regulate

at during the fattening process the propor- a given weight of the body, of water, mineral and nitrogenous compounds decreases, whilst he fat very considerably increases.

at the carcass parts or saleable meat increase pidly than the internal parts or offal.

at the amount of dry substance of food re- o produce a given weight of increase is ith the ox than with the sheep, and larger sheep than with the pig.

at the dry substance of the food of the ox a larger proportion of indigestible matter t of sheep, and that of sheep more than that

at oxen require from 5 to 6, and sheep from mes as much time to add a given proportion eight of their bodies as pigs.

at the greater portion of the nitrogenous and matters of the food is recovered in the ma- nd that the greater part of the non-nitro- abstance is lost by respiration, and other ex- —a much smaller proportion being retained crease, or voided in the manure.

at for a given amount of increase produced, id considerably more substance as manure, nd more in respiration, &c., than sheep, and ry much more than pigs.

at for a given weight of dry substance con- oxen void more as manure than sheep, and ach more than pigs; but oxen respire rather sheep, and sheep rather less than pigs.

at in proportion to a given weight of animal, given time, oxen both consume and respire substance of food than sheep, and sheep very s than pigs; but they void almost identical of dry substance as manure.

parative Feeding Value of different Foods, according to their Composition.

far I have endeavoured to indicate the cha- tic points of distinction between the food of the sheep, and the pig, and to show in what its constituents are differently disposed of by rent animals; and for the purposes of my illus- I have supposed the animals to be fed on such are recognised as appropriate to them, and proportion and amount as experience justifies. propose to say a few words on the relative properties of different foods, according to mposition.

ing out of view, just now, the incombustible eral constituents, it will be convenient, as to consider the other constituents of food to iped under the heads of nitrogenous and non- nous *substances.*

g the nitrogenous substances, the most important of those which enter into our stock foods are albumen, casein, legumin, and gluten; and chemists and physiologists are accustomed to speak of these—the nitrogenous compounds—as the flesh-forming substances.

The non-nitrogenous constituents of our stock foods are starch, sugar, gum, pectin, oil, and cellulose, or woody fibre in different conditions of digestibility or induration. The non-nitrogenous compounds are spoken of as the respiratory or heat-producing, and fat-forming substances.

Now, writers on agricultural chemistry and physiology have generally assumed that it is chiefly the proportion of the nitrogenous or so-called flesh-forming substances contained in them, which determines the comparative value, for feeding purposes, of different foods.

The coloured diagram before you will enable you to judge whether or not this supposition is justified by the practical experience of feeding. This diagram has been constructed by the animals themselves. They know nothing about nitrogenous or non-nitrogenous constituents, digestible or indigestible cellulose, and so on; but they are gifted with an unerring instinct which enables them not only to distinguish between substances which are and are not food, but also to select from a variety of food stuffs those which are most suitable for the requirements of the system, and so to indicate to us the proper amounts and proportions of the different constituents.

In the experiments to which the diagram refers, as well as in many others, the plan has been to select foods containing very different proportions of nitrogenous and non-nitrogenous compounds; in fact, some containing two or three times as much nitrogen as others. We have then given to one set of animals a small fixed amount daily, of food containing a low percentage of nitrogen, and allowed them to take as much as they chose of another food, different in composition in this respect. To another set we have given a limited amount of food, rich in nitrogenous compounds, and allowed the animals to take, *ad libitum*, of a different description of food, and so on. In this way they have been enabled to fix for themselves the limit of their consumption of nitrogenous and non-nitrogenous constituents respectively, according to their wants.

The diagram shows the results of such experiments with pigs; and the foods employed were Indian corn meal, barley meal, bean meal, lentil meal, bran, and dried cod-fish, used alone, or in combination, as the case might be. Black being taken to represent nitrogenous substance, red non-nitrogenous substance, and green total dry organic matter (nitrogenous an non-nitrogenous together), the diagram is construc as follows:—The smallest quantity of nitrogeno

non-nitrogenous, or total organic matter consumed in any one experiment is reckoned as 100; and the several lines above the base line, which is marked 100, indicate larger amounts, corresponding to the figures given at the side of the diagram.

The upper portion shows the relative amounts of each constituent consumed in each experiment per 100 lbs. live weight per week; that is to say, by a given weight of animal within a given time. A glance shows you that the height to which the colours representing the non-nitrogenous, or the total organic substance reach is very much more uniform than that indicating the consumption of nitrogenous substance. In fact, it is perfectly clear that the animals were guided in the amount of food which they consumed by the amount of non-nitrogenous, and not by that of the nitrogenous, constituents which it supplied.

But, according to current theories, the amount of nitrogenous substance ought at least to determine the amount of increase produced. The lower portion of the diagram shows what the animals have to say on this point. The arrangement is the same as before; but the results show not how much of each class of constituents was consumed by a given weight of animal within a given time, but how much was consumed to produce a given weight (100 lbs.) of increase.

Here again we see that the amount of either non-nitrogenous or total organic substance consumed varied comparatively little, whilst that of the nitrogenous substance consumed for the production of a given amount of increase varied from 100 to over 300 parts.

It is obvious, therefore, that both the amount of food consumed by a given weight of animal within a given time, and that required to produce a given weight of increase, were determined by the amount of available non-nitrogenous substance which the food supplied. The quantities required would, doubtless, have varied within even narrower limits, had all the foods contained equal proportions of indigestible woody matter.

It may be observed that it is doubtful whether pigs are able to digest cellulose, or woody fibre, at all; but there is no doubt, as the investigations of ourselves and others on the point sufficiently prove, that oxen and sheep are able to digest a considerable portion of such matter, when it is not in too indurated a condition.

It will, of course, be understood, that a certain amount and proportion of nitrogenous substance is essential in the food of animals; and if I were asked to state, in general terms, what was the approximate proportion of the nitrogenous to the digestible non-nitrogenous substances, below which they should not exist in the food of our stock, I should say (though with reservations) about such as we find them in the cereal grains; and since few of our stock foods are below, and many above, this in the proportion of nitrogenous substance, it results that we are more likely to give an excess than a deficiency of such constituents, so far as the requirements of the animal are concerned. The value of the manure depends, however, very much on the amount of the nitrogen which the food contains; but to this point I shall recur after directing attention to a few more points in connection with the comparative values of different foods as such.

Some years ago we published the results of some experiments on the equivalency of starch and sugar as food, pigs being the subject of the trial. Several lots having each a fixed and limited quantity of lentil-meal and bran allowed, one was permitted to take as much starch, another as much sugar, and another as much of the mixture of the two as they chose; whilst in another experiment the animals were allowed to select at discretion from lentils, bran, sugar, or starch, each placed separately within their reach. The result was, that sugar and starch were found to have, weight for weight, practically the same value as constituents of food.

These results would, *a priori*, lead to an answer in the negative to the much agitated question, whether there is any advantage in malting barley for feeding purposes. The chief effect of the malting process is to convert starch into sugar—not, it is true, sugar of exactly the same description as that used in our experiments; but there is good reason for supposing that malt sugar would have a lower value than cane sugar as a food constituent; and direct experiments, made many years ago at Rothamsted, have shown that a given amount of malt, mixed with other food, gave less rather than more increase than the amount of barley from which it was produced. It is obvious, too, that as the conversion of barley into malt is a manufacturing process, attended with considerable cost, as well as actual loss of substance, the remission of the duty on malt employed for feeding purposes would not be likely to be of benefit to the farmer, unless either a given amount of malt sugar proved to be of considerably higher feeding value than the starch from which it was produced, or the other constituents were rendered more digestible and assimilable by the process.

This leads me, before leaving the subject of food, to make a few remarks on some other manufactured foods for stock. Many complaints are made, and justly made, of the adulteration of oil-cakes; and it is sometimes asserted that cheaper and better food than the average of cakes now in use could be manufactured with advantage both to the maker and to the feeder. Linseed and other cakes are themselves

in one sense, manufactured foods. But the object of the manufacturer is not the production of cake, but of oil. If the farmer did not use the cake at all, it would still be made, and the oil would be sold for a higher price. As it is, the manufacturer makes the cake as a bye-product, and the price he gets for it enables him to sell his oil so much the cheaper.

But if manufactories were set up for the special purpose of preparing foods for stock, the whole cost of the undertakings must be charged upon the food. Lentils, beans, peas, Indian meal, barley meal, linseed, and other good staple foods must be used; and although it might be possible so to combine foods together that a given weight of the mixture would possess a somewhat higher feeding value than the component parts used singly, there is every reason to suppose that the increased cost would more than counterbalance any slight benefit that could be derived in that way. Nor do I anticipate that the progress of science will aid us much in this direction. Condimental foods have been tried, and found wanting; and I have little doubt that a similar result will attend the manufacture and use of simpler food mixtures. Our hopes as feeders must be in increased and cheap supplies of ordinary cattle foods of good quality, rather than in submitting those we have to costly processes of manufacture.

The results arrived at in regard to this portion of the subject may be briefly summed up as follows:—

1. The comparative feeding value of our current stock foods depends more upon the proportion of the digestible non-nitrogenous substances they contain than upon their richness in nitrogenous compounds; but the richer the food in nitrogen, the more valuable will be the manure.

2. Of the non-nitrogenous constituents of food, starch and cane sugar have, weight for weight, nearly equal feeding values; malt sugar has probably rather a lower value than either cane sugar or starch; digestible cellulose, in moderate proportion, has, for ruminant animals, probably nearly the same value as starch; and fat or oil have probably about 2½ times the value of starch for the purposes of respiration, or the storing up of fat in the body.

3. Some advantage results in a feeding point of view from the judicious mixture of a variety of ordinary stock foods; but the benefit to be derived in this way is not such as to compensate for the extra cost of a special manufacturing process to attain it.

Connection between the Value of the Manure and the Composition of the Food consumed.

The next and last branch of the subject relates to the comparative value of the different *constituents* in the liquid and solid *voidings of the animals*, and to the connection between the value of the m
the composition of the food from which it is

I have already pointed out that the great
of the carbon, hydrogen, and oxygen of
either passes into the increase or off in respir
that comparatively little of any of them is
in manure. By far the larger portion of the
and nearly the whole of the mineral matter
are, however, so recovered.

To show the economic connection be
feeding of stock for the production of mea
nure, and the growth of corn, I propose to
few results obtained in experiments on the
wheat by different manures. In the expe
question, wheat has been grown for 20
seasons on the same land.

In Table V. are given the average annu
of corn and straw, and the estimated yield
per acre, over the last 12 years, respectivel
manure, with mineral manure alone, wi
and nitrogenous manure (ammonia salts),
farm-yard manure.

TABLE V.—*Average annual Produce of Whea*
mated yield of Carbon, per acre, over 12

Manures, per acre, per annum.	Average annual produ		
	Dressed Corn.	Total Corn.	Stra
	Bushels.	lbs.	lbs
Unmanured	15¼	964	166
Mineral manure alone ...	18⅜	1157	189
Mineral manure and 400 lbs. ammonia salts	36¼	2275	421
14 tons farm-yard manure	35⅜	2232	386

Where the farm-yard manure was emplo
carbon, as well as more of every other c
was annually applied in manure than remo
crop. In the other cases no carbon wha
supplied in the manure; and yet it will b
that where the mineral manure and amn
were employed (the latter containing a lar
of nitrogen), the yield of carbon was gr
where a large amount of that substance wa
by means of farm-yard manure. This ca
have been derived from the atmosphere.
experiments in this field last year, from 1¾
of carbon per acre were removed in the cro
any being supplied in manure; but in t
large quantities of nitrogen were supplied.

The quantity of carbonic acid required
tons of carbon to the crop is about as muc
be given off into the atmosphere in a year
viduals of a mixed population of both sex
ages, and it will be seen that it is under th
of ammoniacal or nitrogenous manure tha
amount of carbon has been fixed in the p
carbonic acid of the atmosphere.

Table III. showed how small was
nitrogen consumed by an ani-
was stored up in its increase and
at. If there were none of the
lost in the various exhalations
whole of that not stored up in
ound in the manure. But the
selves and others show that a
e nitrogen is so lost. Our own
nine the limit of this loss, and
der which it is greater or less,
ar back as 1847, and have been
from that time to the present;
few years we have collected a
nental data on the subject; but
analytical work is not yet con-
that I am in a position to give
nent of the results obtained. It
ted as beyond doubt, that by far
the nitrogen consumed in food
imals in their liquid and solid
e higher the proportion of nitro-
icher will be the excrements in
ituent of manures.

published a table showing the
the manure obtained from the
on of different articles of food
n practice. The valuation was
ledge of the average composition
iptions of food, and upon infor-
the course of the experiments
the probable average amount of
od valuable for manure which
he solid and liquid excrements of

ts of these valuations in very
ay be said that the estimated
from 1 ton of oil-cake was con-
that from the same quantity of
, beans, or peas; from two to
as that from 1 ton of oats, wheat,
or hay; from seven to ten times
e same weight of oat, wheat, or
about twenty times as much as

refore, that in the selection of
stock, it is very important to
ring as well as their feeding value.
this point will suffice. A ton of
rtainly not yield nitrogen in the
nals consuming it equal to more
s, ¼ cwt., or 28 lbs., of ammonia;
ke will yield 1 cwt., or four times
*fore, we take the ammonia in the
, the amount of it* obtained from
ton of locust beans will be
worth only 16s. 4d.; whilst that from the ton o
cake will be £3 5s. 4d.

There is, in fact, far greater difference in t
nuring than in the feeding value of most
ordinary stock foods in the market.

In illustrating the comparative value of the m
obtained from different foods, by reference me
the amounts of nitrogen or ammonia-yielding
which they supply, it will not be understood
in any way ignore or under-rate the value
mineral constituents associated with the nitro
matter in the excrements. But, inasmuch
amount of mineral constituents voided is ge
in excess of that required for the due effect as m
of the nitrogen with which they are accompa
results that the amount of the nitrogen or am
yielding matter is practically the best index
value of the manure.

Appropriateness of Animal Food in the Diet o

It will be obvious that the importance of th
ject which I have brought before you this e
rests upon the assumption that animal food
important element in the diet of man. The
indeed, some who maintain that a purely ve
diet would be more suitable and natural th
mixed vegetable and animal one so generall
ferred. If their view were adopted, we n
longer trouble ourselves about the connection b
the food, the increase, and the manure of fa
oxen, sheep, and pigs. There are, however,
circumstances, economical and physiological, p
to the appropriateness of admitting a certain p
tion of animal food into the diet of man. To
two of these I will briefly refer.

Walking is for man undoubtedly a very
means of progression. Still, it is often very
tageous to ride, and so to employ the legs of
ruped instead of our own. In eating meat w
be said to employ the stomachs of other ani
do that which we could not so well do with o
As a few ounces of gold are separated fro
tons of rock by the combined aid of mechani
chemical processes, so the animals feeding
crude, and often to us indigestible, vegetable
eliminate from it, and store up in their bodies,
its constituents in a form at once much more
trated than that in which they consumed th
much more easily appropriated by the hum
nomy. A given amount of nitrogenous con
in the form of meat is undoubtedly more ea
gested and assimilated by man than if t
amount were supplied in the form of beans.
again, the animals convert starch, sugar, &
probably some of them cellulose, which we c
digest at all), into fat, which has twice and

respiratory and fat-storing capacity of the substances from which they produce it. It is, doubtless, true that man can produce fat, and keep up his respiratory function, from starch and sugar; but it can hardly be doubted that there is some economy to his system in having a portion of fat supplied to him ready made.

Apart from the strong testimony of common experience on the subject, there is evidence in the comparative structure of man that he is adapted for a concentrated form of food. One illustration, in passing, may be adduced on this point. Table VI. shows the proportion of the stomach, by weight, in a given live weight of oxen, sheep, pigs, and man.

TABLE VI.—*Proportion of stomach in different animals.*

Stomach in 100 lbs. live weight:—

Oxen	... 51 ounces.	Sheep	... 39 ounces.
Pigs	... 14 „	Man	... 6 „

Relative weight does not, of course, necessarily represent with numerical exactness relative capacity or size. But there is little doubt that there is a gradation in the capacity of the stomach relatively to a given weight of the body in the animals enumerated in the order, and to a great extent in the degree indicated by the figures given in the table. Admitting this to be the case, we have seen that the sheep, with its less proportion of stomach than the ox, takes a somewhat more concentrated food; and that the pig, with its much less proportion of stomach than the sheep, requires a much more concentrated food than the latter. May we not conclude that man in his turn, with his less proportion of stomach than the pig, will also appropriately take a more concentrated food than his useful friend?

The food of man is, indeed, very closely allied, in a chemical point of view, to that of the pig. The staple of the food of both the fattening pig, and man, is cereal grain. The pig, it is true, consumes the husk as well as the farinal portion, whilst man does not; but we know that this proportion of indigestible woody matter is very nearly the limit of that which is appropriate for the fattening pig; and that on the addition of a small quantity of bran the proportion of increase diminishes, and that of the dry substance of the food voided as excrement increases. The only other essential difference is, that the pig takes, as a rule, the whole of his nitrogenous compounds in the form of vegetable products, and a much larger proportion of starch, and other non-nitrogenous compounds, more bulky in relation to their respiratory and fat-forming capacity than fat itself. Not, indeed, that the pig is at all unapt or unwilling to adopt even still more closely the diet of man; for he will *take animal flesh* and fat *when he can get them, and, what is more,* he likes *them better cooked than raw.*

Were it not, then, that man separate from the flour, and that he gets lower eliminate in an easily digestible form a p nitrogenous aliment, from foods which h himself readily digest, and that he gets to provide him with a portion of his resp fat-storing food in the concentrated itself, we could hardly account for the tion to a given weight of the body of the the receptacle and first laboratory of the case than in that of the pig. We kno that in the cases where man is reduced for nearly the whole of the non-nitrogen tuents of his food upon starch, in the fo toes or rice, that there is a disposition to ment of the abdominal organs, and to a in physical and mental energy.

To conclude on this point, there can b whatever that the food of the labouring proved when he can add to his bread a po bacon, or butter, or fat in some other it is better still if he can substitute or su little butcher's meat. Indeed, that whic experience recognises as high quality within certain limits, high proportion o vegetable food, and with it high proportio starch and other non-nitrogenous compoun

But not only do the animals which we our own food convert vegetable produce either could not digest at all, or could d easily than they, into concentrated and gestible and assimilable material for our doing this they supply carbonic acid to phere, and return the most important ma stituents of their food in their excren providing, to both the soil and the atmos crude vegetable products, that which is ne the luxuriant growth of cereal grain, and table produce suited for the direct use man.

Were it not for such compensations, by t of man and other animals upon the sur earth (if it could take place at all), by th quantities of carbonic acid evolved into the from the combustion of coal and from oth and by the gradual destruction of forests, w chief natural agents for restoring the b purity of the atmosphere would becom But the grasses, which supply so large a of the food of beasts, and the cereals an plants of the same great family, which sup man in almost every climate, serve to carbon given into the atmosphere in t carbonic acid. It may seem at first that the humble grasses, and the corn ing only a few feet from the surface

should be able to take up more carbonic acid, and evolve more oxygen, over an acre of land than an acre covered with forest trees. Still, there can be little doubt that more carbon is fixed in an acre of luxuriant wheat than over the same area of woodland; and there can be as little that an acre of sugar cane would fix more than an equal area of the most luxuriant tropical forest.

Conclusion.

With a few general remarks of a practical nature, I will conclude my discourse. The great change which has taken place in the practice of feeding stock in modern times has consisted in bringing the animals much earlier to maturity, by means of careful breeding, and more liberal feeding. Scales and weights were seldom used in agricultural experiments until comparatively recently; but there are some few records of the results of feeding as practised at the latter end of the last century, which will serve us in instituting a comparison between the results then obtained and those which are possible, or even common, at the present day.

In 1794 the Duke of Bedford made some experiments to determine the comparative feeding qualities of South Down, Leicester, Worcester, and Wiltshire sheep. Twenty of each were selected and weighed on November 19, 1794. To each lot were allotted 16 acres of pasture, and in the winter some turnips were thrown upon the pasture, and a small quantity of hay was also provided. On February 16, 1796, after a period of 65 weeks of feeding, the experiment was concluded, and the sheep sent to market.

Over the whole period the sheep gave an average increase of between 40 and 50 lbs. per head; and as their original weight was nearly 100 lbs. per head, they increased nearly 50 per cent. from the store or lean to the fat condition, which is the same proportion as that assumed in the illustrations to which Table III. refers.

Some years ago, I tried a set of experiments upon the comparative fattening qualities of South Downs, Hampshire Downs, Cotswolds, Leicesters, and cross-bred wethers, and cross-bred ewes, each lot consisting of between 40 and 50 sheep. They were put up in November, when their weights averaged very nearly the same as those of the Duke of Bedford's sheep; and when fat, they had increased in about the same degree, namely, to an average of about 150 lbs. each. The Duke of Bedford's sheep were about 65 weeks in adding 50 lbs. to their weight, and mine in some cases 20, and in others a little more, or about one-third the time. It is somewhat singular that in May—the at which my sheep were consumed as mutto Duke of Bedford's were weighed for the first tin the commencement of the experiment, and wer to have increased only about 6 lbs. per head.

The difference of result in these two ca almost entirely due to the difference in the n feeding. Formerly, sheep received perhaps turnips on their pasture, and but little dry fo that not of high feeding quality; and the cons was, that during the colder months of the ye either lost weight or increased but little. No have a liberal allowance of good food, and quently protected from the inclemency of the w In my own experiments, just referred to, th were allowed from ¾ lb. to 1 lb. of oil-c head per day, according to their weight, ab same amount of clover chaff, and as many sw they chose to eat; and they gave an aver crease of nearly 2 per cent. upon their wei week.

There is no doubt that in rapidly fattening stoc early age, quality of meat is to some extent sa to quantity. But it is only by means of the system of liberal feeding and early maturi meat can be brought within the reach of the of the population. The farmer, too, must that system which will pay him the best; difference between the price which the consur give for a pound of four-year-old and one-y mutton will, only under very exceptional stances of locality, remunerate him for the ex of production.

In conclusion, I have only now to thank the very kind attention with which you have f me through what I fear may be thought by you somewhat tedious detail. The subject chemistry of feeding is, however, essentially tricate one; and I think you will have learnt f lecture, if you did not know it before, that th remains much to be determined by careful in tion respecting it. But if I have in any deg ceeded in indicating the proper points of vie which this, at once practical and scientific, should be studied, and in impressing upon you some prominent and important facts regardi as to lead to improvement in practice by knowledge of principle, or to further inquiry to an extension of our knowledge, I shall f the objects of my desire and endeavour in ad you have been fully attained.

AVERAGE COMPOSITION, PER CENT. AND PER TON, OF VARIOUS KINDS C AGRICULTURAL PRODUCE, &c.

	Per Cent.					Lbs. per Ton.			
	Total Dry Matter.	Total Mineral Matter (ash).	Phosphoric Acid, reckoned as Phosphate of Lime.	Potash.	Nitrogen.	Total Dry Matter.	Total Mineral Matter (ash).	Phosphoric Acid, reckoned as Phosphate of Lime.	Potash.
1. Linseed Cake	88.0	7.00	4.92	1.65	4.75	1971	156.8	110.2	37.0
2. Cotton Seed Cake	89.0	8.00	7.00	3.12	6.50	1994	179.2	156.8	70.0
3. Rape Cake	89.0	8.00	5.75	1.76	5.00	1994	179.2	128.8	39.4
4. Linseed	90.0	4.00	3.38	1.37	3.80	2016	89.6	75.7	30.7
5. Beans	84.0	3.00	2.20	1.27	4.00	1882	67.2	49.3	28.4
6. Peas	84.5	2.40	1.84	0.96	3.40	1893	53.8	41.2	21.5
7. Tares	84.0	2.00	1.63	0.66	4.20	1882	44.8	36.5	14.8
8. Lentils	88.0	3.00	1.89	0.96	4.30	1971	67.2	42.3	21.5
9. Malt Dust	94.0	8.50	5.23	2.12	4.20	2106	190.4	117.1	47.5
10. Locust Beans	85.0	1.75			1.25	1904	39.2		
11. Indian Meal	88.0	1.30	1.13	0.35	1.80	1971	29.1	25.3	7.8
12. Wheat	85.0	1.70	1.87	0.50	1.80	1904	38.1	42.0	11.2
13. Barley	84.0	2.20	1.35	0.55	1.65	1882	49.3	30.2	12.3
14. Malt	95.0	2.60	1.60	0.65	1.70	2128	58.2	35.8	14.6
15. Oats	86.0	2.85	1.17	0.50	2.00	1926	63.8	26.2	11.2
16. Fine Pollard	86.0	5.60	6.44	1.46	2.60	1926	125.4	144.2	32.7
17. Coarse Pollard	86.0	6.20	7.52	1.49	2.58	1926	138.9	168.4	33.4
18. Bran	86.0	6.60	7.95	1.45	2.55	1926	147.8	178.1	32.5
19. Clover Hay	84.0	7.50	1.25	1.30	2.50	1882	168.0	28.0	29.1
20. Meadow Hay	84.0	6.00	0.88	1.50	1.50	1882	134.4	19.7	33.6
21. Bean Straw	82.5	5.55	0.90	1.11	0.90	1848	124.3	20.2	24.9
22. Pea Straw	82.0	5.95	0.85	0.89		1837	133.3	19.0	19.9
23. Wheat Straw	84.0	5.00	0.55	0.65	0.60	1882	112.0	12.3	14.6
24. Barley Straw	85.0	4.50	0.37	0.63	0.50	1904	100.8	8.3	14.1
25. Oat Straw	83.0	5.50	0.48	0.93	0.60	1859	123.2	10.7	20.8
26. Mangold Wurzel	12.5	1.00	0.09	0.25	0.25	280	22.4	2.0	5.6
27. Swedish Turnips	11.0	0.60	0.13	0.18	0.22	246½	13.4	2.9	4.0
28. Common Turnips	8.0	0.68	0.11	0.29	0.18	179¼	15.2	2.5	6.5
29. Potatoes	24.0	1.00	0.32	0.43	0.35	537½	22.4	7.2	9.6
30. Carrots	13.5	0.70	0.13	0.23	0.20	302½	15.7	2.9	5.1
31. Parsnips	15.0	1.00	0.42	0.36	0.22	336	22.4	9.4	8.1

SEWAGE OF TOWNS.

THIRD REPORT

OF

THE COMMISSION

APPOINTED

TO INQUIRE INTO THE BEST MODE

OF

DISTRIBUTING THE SEWAGE OF TOWNS,

AND

APPLYING IT TO BENEFICIAL AND PROFITABLE USES;

WITH APPENDICES 1, 2, AND 3.

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

1865.

CONTENTS

THIRD REPORT OF THE COMMISSION.

To the Lords Commissioners of Her Majesty's Treasury.

May it please your Lordships,

We, the undersigned, whom Her Majesty's Commission, bearing date 5th January 1857, appointed to "inquire into the "best mode of distributing the Sewage of Towns, and applying "it to beneficial and profitable uses," have now again, according to our instructions, the honour of reporting to your Lordships our further progress in the matter committed to us for inquiry.

Since the date of our last Report (August 1861) we have, through a committee of our number, consisting of Mr. Lawes and Professor Way, continued at Rugby the experiments which were undertaken in 1861 on the application of sewage to land. The report of that committee, which we append, contains the results for the three years 1862–4.

Your Lordships will observe that these experiments have not been confined to the application of sewage in different quantities to land, but have extended to the consumption, by cattle, of the produce so obtained, and to the production of meat and milk, and have been accompanied by a careful record of the quantities and market-value of the products, and by numerous analyses of the sewage before and after irrigation, as also of the grass and of the milk.

It appears to us that these experiments have solved many of the difficulties which have hitherto attached to the question of the agricultural application of sewage, and that they leave no reasonable doubt of the practicability and advantage of so employing the sewage of towns.

We have also continued to give our best attention to all kindred experiments and inquiries which have been going on elsewhere.

As the results of our labours, extending over eight years, we have confidence in submitting to your Lordships the following conclusions:—

1. The right way to dispose of town sewage is to apply it continuously to land, and it is only by such application that the pollution of rivers can be avoided.
2. The financial results of a continuous application of sewage to land differ under different local circumstances; first, because in some places irrigation can be effected by gravity, while in other places more or less pumping must be employed; secondly, because heavy soils (which in

given localities may alone be available for the purpose) are less fit than light soils for continuous irrigation by sewage.

3. Where local circumstances are favourable, and undue expenditure is avoided, towns may derive profit, more or less considerable, from applying their sewage in agriculture. Under opposite circumstances, there may not be a balance of profit; but even in such cases a rate in aid, required to cover any loss, needs not be of large amount.

Finally, on the basis of the above conclusions, we further beg leave to express to your Lordships that, in our judgment, the following two principles are established for legislative application:—

First, that, wherever rivers are polluted by a discharge of town sewage into them, the towns may reasonably be required to desist from causing that public nuisance:

Second, that where town-populations are injured or endangered in health by a retention of cesspool-matter among them, the towns may reasonably be required to provide a system of sewers for its removal.

And should the law, as it stands, be found insufficient to enable towns to take land for sewage-application, it would, in our opinion, be expedient that the legislature should give them powers for that purpose.

(Signed) ESSEX.
ROBERT RAWLINSON.
J. THOMAS WAY.
J. B. LAWES.
JOHN SIMON.

8, Richmond Terrace, Whitehall,
March 1865.

SECOND REPORT of EXPERIMENTS on the APPLICATION of TOWN SEWAGE to GRASS LAND, conducted at RUGBY, by ORDER of the ROYAL SEWAGE COMMISSION.

SEASONS 1861, 1862, and 1863.

IN the Second Report of the Commission, presented to both Houses of Parliament in 1862, an account was given of the results obtained in the First Season (1861) of Experiments on the application of town sewage to grass land, which were undertaken by order of the Royal Sewage Commission, and conducted in the neighbourhood of Rugby, where, arrangements being made for the distribution of the sewage of the town over a considerable area of adjacent land, the conditions were considered well adapted for the purposes of the inquiry.

As stated in the preliminary Report above referred to, the Commission, guided by the information acquired in the course of their investigation of the then existing experience on the subject, which had led them to visit almost every locality where town sewage was applied in any way to the purposes of agriculture, had come to the conclusion that to obtain the largest amount and value of produce at the least proportionate cost for distribution, dilute town sewage should be applied to the growth of succulent crops, and that it was best adapted for grass. It was decided, therefore, to confine attention, at any rate in the first instance, to grass alone.

In arranging the experiments, it was considered that the object was to provide such information as might be taken as the basis of arrangements for the application of the sewage of towns, in the manner the most advantageous to both urban and rural interests.

To this end it was sought to determine:—

1. The amount and the composition of the produce, in relation— to the amount of water supplied to the land by irrigation, to the amount of manurial constituents so applied, and to the amount of population contributing the manurial constituents to the water.
2. The most profitable method of utilising the produce; that is, whether it should be used in the green state or as hay; whether for the production of milk or of meat; and whether it should be consumed alone or in conjunction with *other food.*

In the experiments of the first year, three portions of land, of about five acres each, were operated upon, and each of these was divided into four plots, to be treated, respectively, as follows:

Plot 1. To be unsewaged.

Plot 2. To be irrigated with sewage at the rate of 3,000 tons per acre per annum.

Plot 3. To be sewaged at the rate of 6,000 tons per acre per annum.

Plot 4. To be sewaged at the rate of 9,000 tons per acre per annum.

The produce of one such set of four plots was to be given, in the green state, to fattening oxen; that of the second (also in the green state) to milking cows; and that of the third was to be made into hay.

As explained in the former Report, owing to deficient supply, but little sewage was applied to the portion of land devoted to the production of hay; and, since the first season, the five acres in question have each year been sublet.

The results obtained in the first year's experiments on the other portions of land were given in detail in the previous Report; but it was admitted that the experience of one year only could be taken as little more than initiative on many points; it being obviously essential to determine the effects of the continued application, and the influence of seasons of different characters, before safe deductions could be drawn in regard to some of the most important economical questions at issue.

The results of two more seasons (1862 and 1863) are now at command; and it is proposed to call attention chiefly to the difference of result obtained in the different seasons, and to the average result over the three seasons, making but few comments on those of each separate season. The full details will, however, be given for reference, in the tabular form, in Appendix, No. 1., p. 81, et seq.

In addition to the experiments above referred to, which are a continuation of those already reported, by the kindness of Mr. Campbell some results obtained on the application of sewage to Italian rye-grass and to oats are also given.

For the convenience of reference and comparison, the numerical results will, as far as possible, be arranged in the same form, and the subject considered in the same order, as in the former Report.

I. *Quantities of Sewage applied, and of Green Produce obtained.*

In the first season (1861) the application of sewage did not commence until March in the one field, and April in the other; but, as it was considered that any scheme for the general application of town sewage to agricultural purposes must of necessity *be based on the fact* of a daily supply the year round, which

must be dealt with in winter when of comparatively little value as well as in summer when of more, the amounts of 3,000, 6,000, and 9,000 tons, respectively, were, in the second and third seasons, distributed over the entire year, and the quantities supplied from November 1st of one year to October 31st of the next were taken as those to which the increase of crop was due.

The detailed records relating to the application of the sewage are given for reference in Tables I. and II. pp. 81–89. Appendix, No. 1. Of these, Table I., which now follows, is a convenient summary.

TABLE I.—Quantities of Sewage applied per Acre, on each Plot, in each Month, in each of the Three Seasons.

—	Sewage per Acre.					
	Five-acre Field.			Ten-acre Field (half).		
	Plot 2.	Plot 3.	Plot 4.	Plot 2.	Plot 3.	Plot 4.
1st Season, 1861; March—October, inclusive.						
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
March - -	632·1	1045·1	1444·2	..	..	..
April - - -	279·9	666·4	1177·0	563·0	1145·9	1376·9
May - -	75·8	96·5	97·7	18·3	64·1	118·8
June - - -	78·8	223·3	577·2	..	..	392·3
July - -	531·7	430·2	654·1	512·0	392·2	905·7
August - -	130·6	580·2	787·3	225·9	316·3	595·1
September -	143·1	703·3	614·7	34·0	517·7	381·8
October - -	201·7	678·2	800·7	34·0	367·7	455·8
Totals - -	2073·7	4423·2	6152·9	1387·2	2803·9	4226·4
Rate per annum -	3110·4	6634·8	9229·1	2378·1	4806·7	7245·4
2d Season, 1862; November 1861—October 1862, inclusive.						
November 1861 -	313·1	499·8	745·0	116·3	341·5	451·4
December „ -	126·6	429·8	527·6	71·5	143·5	277·2
January 1862 -	323·0	457·6	583·3	77·4	159·2	235·7
February „ -	169·2	575·0	751·6	227·5	187·2	339·1
March „ -	235·4	455·8	478·2	109·9	374·0	524·7
April „ -	211·8	503·0	720·1	508·5	903·5	876·3
May „ -	281·8	581·4	763·0	289·6	425·1	1201·5
June „ -	77·1	164·7	292·7	173·0	327·0	410·0
July „ -	589·1	840·4	1823·7	595·5	1255·9	2017·0
August „ -	309·1	476·9	1442·0	397·5	1000·8	1385·6
September „ -	79·4	623·6	628·6	177·6	396·3	776·9
October „ -	285·2	386·5	730·9	255·2	485·5	517·8
Totals -	*2991·8*	*5994·5*	8986·7	2999·5	5000·5	9004·8

Table I.—*continued.*

tities of Sewage applied per Acre, on each Plot, in each Month, in each of the Three Seasons.

—	Sewage per Acre.					
	Five-acre Field.			Ten-acre Field (half).		
	Plot 2.	Plot 3.	Plot 4.	Plot 2.	Plot 3.	Plot 4.
3d Season, 1863; November 1862—October 1863, inclusive.						
ıber 1862 -	201·9	513·0	806·8	288·2	597·6	771·3
ber „ -	114·2	315·2	500·1	151·6	625·5	894·6
ry 1863 -	351·2	499·3	580·2	493·6	436·0	849·3
ary „ -	194·6	550·6	655·4	200·9	550·9	1013·6
„ -	482·7	774·4	1375·8	203·9	390·8	397·0
„ -	234·2	550·9	640·5	203·9	395·8	592·5
„ -	90·4	579·3	555·3	39·8	582·9	742·3
„ -	896·6	540·9	462·5	385·4	974·8	949·1
„ -	100·9	426·4	980·6	492·4	344·8	779·6
t „ -	..	409·5	964·2	150·0	..	717·0
ıber „ -	275·1	617·3	660·3	..	640·9	495·1
r „ -	57·1	232·8	819·0	391·3	459·8	797·1
Totals -	2998·9	5999·6	9000·7	3001·0	5999·8	8998·5
Summary. 1861, 1862, and 1863.						
eason; to 31, 1861 -	2073·7	4423·2	6152·9	1387·2	2803·9	4226·4
eason; to 31, 1862 -	2991·8	5994·5	8986·7	2999·5	5999·5	9004·3
ason; to 31, 1863 -	2998·9	5999·6	9000·7	3001·0	5999·8	8998·5
Totals -	8064·4	16417·3	24140·3	7387·7	14803·2	22229·2

is seen that when calculated over the entire season the supply ewage was in each case very nearly at the rate intended, but it varied considerably from month to month. Regularity in respect was, indeed, sought to be attained within certain s, but it was necessarily subject to various controlling circum- ces. Thus, the sewage was, as a rule, applied on the same for an entire day at a time, in order the better to secure its distribution over the whole, and the rate of flow, and con- ently the day's supply, varied considerably. Then, again, ughout the summer months the stage of growth of the crop h influenced the time of application, which was regulated to ensure, as far as possible, the beneficial action of the total ntity applied in each case. Occasionally, too, the supply was rely stopped, owing to derangements in the machinery, a ter over which there was unfortunately no control.

he amounts of green grass obtained from the respective plots, ach of the three seasons, are shown in Tables II. and III. 9 and 10); Table II. giving the amounts obtained in each *ate month, and* Table III. those in each successive crop. For *r details, see* Appendix Tables, III. and IV., pp. 90–96.

Table II.—Amount of Green Grass obtained during each separate Month.

—	Green Grass per Acre.																															
	Five-acre Field.																Ten-acre Field (half).															
	Without Sewage.				With Sewage.												Without Sewage.				With Sewage.											
	Plot 1.				Plot 2.				Plot 3.				Plot 4.				Plot 1.				Plot 2.				Plot 3.				Plot 4.			
	tons.	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*
First Season, 1861.																																
May -	-	-	-	-	-	-	-	-	-	-	-	-	1	9	3	14	-	-	-	-	0	14	0	20	1	4	0	10	2	5	0	0
June -	3	2	3	27	4	17	0	14	7	19	1	23	8	14	3	8	4	10	1	1	4	11	2	8	5	4	1	7	8	16	1	7
July -	3	1	0	8	2	8	0	15	4	6	0	26	6	14	0	13	0	8	1	18	5	5	1	2	5	8	0	19	1	16	3	24
Aug. -	-	-	-	-	3	16	2	23	4	12	2	8	5	19	2	24	1	6	3	9	0	10	2	26	4	12	1	1	5	4	2	7
Sept. -	2	2	2	8	1	3	0	12	6	5	1	7	5	0	0	5	2	3	2	7	0	11	0	13	1	15	0	3	4	16	2	0
Oct. -	0	19	0	18	2	11	3	0	0	8	0	24	0	16	0	23	0	9	0	8	3	19	1	15	4	0	3	7	3	6	0	2
Nov. -	-	-	-	-	-	-	-	-	3	9	1	6	4	2	0	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dec. -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	4	0	2	0	7	3	21	0	8	2	0
Totals	9	5	3	5	14	16	3	8	27	1	0	10	32	16	3	8	8	18	0	15	15	16	3	2	23	15	2	12	26	13	3	12
Second Season, 1862.																																
May -	-	-	-	-	0	19	1	19	9	15	3	9	8	7	3	6	0	17	1	16	1	14	0	5	11	13	2	7	8	14	0	21
June -	0	8	1	26	5	10	0	10	5	16	0	26	5	15	1	15	7	10	2	11	15	0	0	3	2	7	2	20	1	15	1	7
July -	3	16	0	23	8	2	3	3	-	-	-	-	4	19	1	19	2	11	2	0	0	8	2	24	6	9	3	6	8	16	1	2
Aug. -	2	8	2	10	4	16	2	16	9	12	0	25	2	0	2	24	0	11	3	0	6	12	1	3	-	-	-	-	2	15	3	8
Sept. -	-	-	-	-	4	0	1	10	6	12	2	10	9	15	0	0	3	8	0	17	0	16	0	8	9	16	1	22	6	2	2	12
Oct. -	1	10	0	7	4	8	3	16	2	13	1	5	1	11	1	14	-	-	-	-	3	0	0	5	1	14	3	15	3	8	0	26
Nov. -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	10	3	9	-	-	-	-	-	-	-	-	-	-	-	-
Totals	8	3	1	10	27	18	0	18	34	10	0	19	32	9	2	22	16	10	0	25	27	11	0	20	32	2	1	14	31	12	1	20
Third Season, 1863.																																
April -	-	-	-	-	-	-	-	-	-	-	-	-	3	16	3	12	-	-	-	-	-	-	-	-	-	-	-	-	3	14	3	[illegible]
May -	-	-	-	-	4	9	1	25	12	4	3	18	6	0	0	15	-	-	-	-	-	-	-	-	9	0	0	24	4	7	2	27
June -	-	-	-	-	6	4	3	3	3	9	2	20	10	13	2	0	3	7	3	25	13	1	3	22	5	16	0	22	11	13	2	21
July -	3	18	3	14	6	7	3	9	5	17	2	2	-	-	-	-	2	19	3	27	5	13	0	6	4	15	0	13	0	9	3	12
Aug. -	-	-	-	-	-	-	-	-	4	2	3	5	7	15	3	16	-	-	-	-	-	-	-	-	5	14	3	0	7	16	2	14
Sept. -	0	19	3	27	2	7	1	27	6	12	0	23	7	14	0	2	1	12	3	23	6	1	0	2	1	5	1	12	0	12	3	[illegible]
Oct. -	-	-	-	-	2	12	1	15	2	5	3	5	0	14	1	20	-	-	-	-	-	-	-	-	3	9	3	20	5	12	2	[illegible]
Nov. -	-	-	-	-	0	3	0	16	0	5	2	10	0	5	2	24	-	-	-	-	0	9	1	6	0	10	0	5	0	11	2	[illegible]
Totals	4	18	3	13	22	5	0	11	34	18	1	27	37	0	2	5	8	0	3	19	25	[illegible]	1	8	30	11	2	12	34	19	1	[illegible]

Table III.—Amounts of Green Grass obtained in each successive Crop.

—	Green Grass per Acre.																															
	Five-acre Field.																Ten-acre Field (half).															
	Without Sewage.				With Sewage.												Without Sewage.				With Sewage.											
	Plot 1.				Plot 2.				Plot 3.				Plot 4.				Plot 1.				Plot 2.				Plot 3.				Plot 4.			
First Season, 1861.																																
	tons.	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*
1st Crop -	6	4	0	7	7	5	1	1	10	7	0	24	13	5	1	22	4	18	2	19	9	13	3	12	11	5	3	2	11	1	1	4
2d Crop -	3	1	2	26	4	3	1	25	7	8	1	0	9	15	0	11	3	19	1	24	2	11	0	0	5	18	2	17	7	1	2	6
3d Crop -	-	-	-	-	3	4	0	11	5	16	1	8	5	14	0	26	-	-	-	-	3	2	3	16	5	3	1	0	8	2	2	2
4th Crop -	-	-	-	-	0	3	3	27	3	9	1	6	4	2	0	5	-	-	-	-	0	4	0	2	0	7	3	21	0	8	2	0
Totals	9	5	3	5	14	16	3	8	27	1	0	10	32	16	3	8	8	18	0	15	15	16	3	2	22	15	2	12	26	13	3	12
Second Season, 1862.																																
1st Crop -	6	13	1	3	14	12	1	4	15	12	0	7	14	3	0	21	10	19	1	27	16	14	0	8	14	1	0	27	8	14	0	21
2d Crop -	1	10	0	7	8	16	3	26	9	12	0	25	7	0	0	15	3	19	3	17	7	0	3	27	6	9	3	6	10	11	2	9
3d Crop -	-	-	-	-	3	18	1	9	8	1	0	5	9	15	0	0	1	10	3	9	3	7	3	2	9	16	1	22	8	18	1	20
4th Crop -	-	-	-	-	0	10	2	7	1	4	3	10	1	11	1	14	-	-	-	-	0	8	1	11	1	14	3	15	3	2	0	5
5th Crop -	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	6	0	21
Totals	8	3	1	10	27	18	0	18	34	10	0	19	32	9	2	22	16	10	0	25	27	11	0	20	32	2	1	14	31	12	1	20
Third Season, 1863.																																
1st Crop -	3	18	3	14	10	14	1	0	12	4	3	18	9	16	3	27	6	7	3	24	13	1	3	22	12	9	0	7	8	2	1	27
2d Crop -	0	19	3	27	6	7	3	9	9	7	0	22	10	13	2	0	1	12	3	23	5	13	0	6	7	2	1	24	11	13	2	21
3d Crop -	-	-	-	-	4	2	3	24	7	2	3	1	6	18	2	5	-	-	-	-	6	1	0	2	7	0	0	12	8	6	1	26
4th Crop -	-	-	-	-	0	16	3	18	5	18	0	4	8	11	1	13	-	-	-	-	0	9	1	6	3	9	3	20	6	5	1	3
5th Crop -	-	-	-	-	0	3	0	16	0	5	2	10	0	14	1	20	-	-	-	-	-	-	-	-	0	10	0	5	0	11	2	0
6th Crop -	-	-	-	-	-	-	-	-	-	-	-	-	0	5	2	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Totals	4	18	3	13	22	5	0	11	34	18	1	27	37	0	2	5	8	0	3	19	25	5	1	8	30	11	2	12	34	19	1	21
Summary—1861, 1862, and 1863.																																
1861 -	9	5	3	5	14	16	3	8	27	1	0	10	32	16	3	8	8	18	0	15	15	16	3	2	22	15	2	12	26	13	3	12
1862 -	8	3	1	10	27	18	0	18	34	10	0	19	32	9	2	22	16	10	0	25	27	11	0	20	32	2	1	14	31	12	1	20
1863 -	4	18	3	13	22	5	0	11	34	18	1	27	37	0	2	5	8	0	3	19	25	5	1	8	30	11	2	12	34	19	1	21
Average -	7	9	1	9	21	13	1	12	32	3	1	0	34	2	1	12	11	8	0	10	22	17	3	1	28	9	3	13	31	1	3	18

Table II. shows that the crops obtained before the end of May were very much larger in the second and third seasons than in the first season, in which case no sewage had been applied during the winter months. The much greater luxuriance of growth in the early season was, indeed, remarkable after the winter applications; and the crops were invariably in the most forward condition where the largest quantities of sewage had been applied. There is, of course, a great advantage in getting an early cut of green food, and a given weight will be worth more quite early in the season than some weeks later. Still, it is not to be supposed that the same amount of increase of produce will be obtained for a given amount of sewage applied during winter, as during the periods of active growth.

It is also to be observed that the crops obtained late in the season, in September and afterwards for example, were always considerably heavier with sewage than without it, heavier with 6,000 tons than with 3,000, and generally heavier with 9,000 than with 6,000.

Thus, not only was the total amount of produce obtainable per acre very much increased by the application of sewage, but the period during which an abundance of green food was available was extended considerably, both at the beginning and the end of the season, and it was the more so the larger the quantity of sewage applied, almost up to the highest amount adopted in the experiments, namely, 9,000 tons per acre.

Table III. shows that in only one instance, that of the 10-acre field in the wet and cold season of 1862, was there any third cut at all without sewage, whilst, with sewage, four or more cuttings were always obtained, and the later crops were pretty uniformly the larger the larger the quantity of sewage applied.

Leaving the question of the amounts of produce obtained during each separate month, or at each successive cutting, Table IV. shows the total amount of produce on each plot, in each of the three seasons, and also the amount of increase for every 1,000 tons of sewage applied; and produce and increase are each recorded both as green grass, and calculated as hay. The means of the results obtained in the two fields are also given.

TABLE IV.—Total Amounts of Produce, and the Increase for 1,000 Tons of Sewage applied, both reckoned as Green Grass, and calculated as Hay.

SEASONS 1861, 1862, and 1863.

	Five-acre Field.				Ten-acre Field (half).				Mean of the two Fields.			
	Without Sewage.	With Sewage.			Without Sewage.	With Sewage.			Without Sewage.	With Sewage.		
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 1.	Plot 2.	Plot 3.	Plot 4.
Produce per Acre, per Annum, as Green Grass.												
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
1861 - -	9 5 3 5	14 16 3 8	27 1 0 10	32 10 3 8	8 18 0 15	16 16 3 2	23 16 3 12	26 13 3 12	9 1 3 24	16 6 3 5	24 18 1 11	29 15 1 10
1862 - -	8 3 1 10	27 18 0 18	34 10 0 16	32 9 2 23	16 10 0 25	27 11 0 20	32 8 1 14	31 13 1 20	18 6 3 1	27 14 2 19	33 0 1 3	33 1 0 7
1863 - -	4 18 3 13	22 5 0 11	34 18 1 27	37 0 3 5	8 0 3 19	25 5 1 8	30 11 2 12	34 19 1 21	6 9 3 16	23 15 0 24	32 15 0 6	35 19 3 27
Average -	7 9 1 9	21 13 1 12	33 3 1 0	34 2 1 12	11 8 0 10	22 17 3 1	28 9 3 13	31 1 3 18	9 6 0 24	[illegible] 5 2 7	31 0 3 6	32 13 0 16
Produce per Acre, per Annum, calculated as Hay.*												
1861 - -	2 19 0 17	4 3 1 24	6 3 0 6	7 5 0 27	2 11 1 24	3 15 2 20	4 9 1 6	5 5 1 4	2 15 1 7	3 19 2 8	5 6 0 17	6 5 1 2
1862 - -	2 10 1 23	6 8 2 13	6 19 2 16	6 2 0 11	4 13 3 4	5 17 3 16	5 14 1 6	6 10 1 16	3 19 0 14	6 3 1 1	6 16 3 24	6 6 0 27
1863 - -	2 2 0 10	5 4 0 22	6 2 1 1	7 1 0 13	3 7 2 27	5 0 3 16	6 4 1 25	6 12 3 2	2 14 3 19	5 2 2 6	6 3 1 13	6 16 3 20
Average -	2 10 2 7	5 5 1 20	6 1 2 15	6 16 0 17	3 11 0 0	[illegible] 16 0 18	5 9 1 3	6 2 3 7	3 0 3 4	5 1 3 5	5 15 1 23	6 9 1 26
Increase, reckoned as Green Grass, for each 1,000 Tons of Sewage applied.												
1861 - -	..	2 19 1 7	4 0 1 9	3 16 2 6	..	4 19 3 23	4 16 3 23	4 4 0 20	..	3 10 2 15	4 9 2 16	4 0 1 13
1862 - -	..	6 11 3 23	4 7 3 16	2 14 0 13	..	3 13 2 20	2 12 0 4	1 13 2 7	..	5 2 3 8	3 9 3 24	2 3 3 16
1863 - -	..	6 16 1 22	4 19 3 21	3 11 1 4	..	5 14 3 1	3 15 0 13	2 19 3 10	..	5 15 0 12	4 7 2 3	3 5 2 7
Average -	..	5 9 0 27	4 9 1 16	3 7 1 8	..	4 16 0 16	3 15 1 13	2 19 0 22	..	4 19 0 [illegible]	4 3 1 14	3 3 1 [illegible]
Increase, calculated as Hay, for each 1,000 Tons of Sewage applied.*												
1861 - -	..	0 12 3 20	0 14 1 21	0 12 3 27	..	0 17 2 8	0 13 2 6	0 12 3 3	..	0 15 1 0	0 14 0 0	0 13 1 16
1862 - -	..	1 6 0 14	0 11 2 5	0 7 3 25	..	0 8 0 4	0 3 1 19	0 4 0 7	..	0 17 0 9	0 7 1 26	0 6 0 2
1863 - -	..	1 0 2 23	0 13 1 13	0 11 0 0	..	0 11 0 6	0 9 1 23	0 7 0 25	..	0 16 3 15	0 11 1 18	0 9 0 13
Average -	..	0 19 3 19	[illegible] 13 [illegible] 13	0 10 3 27	..	0 12 0 25	0 8 3 7	0 8 0 3	..	0 16 0 8	0 10 3 24	0 9 2 1

In the first and third years (1861 and 1863) there was, in both fields, more produce, whether reckoned as green grass or as hay, with each increased amount of sewage applied. In the wet and cold season of 1862, however, although there was considerably more green produce per acre from 6,000 tons of sewage than from 3,000, yet, owing to its more succulent condition, the amounts with the larger quantities of sewage represented even a few cwts. less of hay. On the other hand, with 9,000 tons of sewage, the produce of green grass was, in this wet season, in both fields, less than with 6,000 tons, but calculated as hay it was slightly more. In no case, however, is the increase with the larger amounts of sewage in proportion to the increased application. This point is well illustrated in the two lower sections of Table IV., which give, not the produce per acre, but the increase for each 1,000 tons of sewage applied, reckoned respectively as green grass and as hay.

It is obvious that the proportion of the produce to be reckoned as increase due to the sewage applied must depend very much on the yield of the unmanured land with which the produce of the sewaged land is to be compared. It is necessary, therefore, to bear in mind the quality and condition of the land upon which the experiments were made, when estimating and judging of the amounts of increase yielded for a given amount of sewage applied. Both fields were fattening pastures. It may safely be concluded, therefore, that their natural or unmanured produce would be higher than that of the average of such land as would be likely to be devoted to the growth of grass by means of sewage on the large scale. On the other hand, there is no reason to suppose that under the influence of a liberal supply of sewage, the produce would be in a corresponding degree higher on land of high natural yield than on land which, from its suitable physical qualities, might, with sewage, yield heavy crops, but without it, very light and poor ones. Then, again, a large proportion of the grasses of a good fattening pasture will yield less produce under the influence of sewage than others associated with them, and it is not until the application has been continued for some years that the more freely growing grasses become so far dominant as to secure the maximum result for a given amount of sewage that soil and season will admit of. For these reasons it seems probable that the amounts of *increase* obtained for a given amount of sewage, applied in these experiments, are more likely to be below than above those which may be anticipated on the continued application of sewage, over large areas of land, selected, prepared, and properly seeded for the purpose.

As between the two fields, it should be stated that, to the five-acre field no sewage had been applied during the season preceding the commencement of the experiments; one crop of hay had been taken from it, and it had afterwards been eaten down by sheep. To the ten-acre field, however, sewage had been applied in indefinite quantity for nearly 12 months; two crops of hay had been taken from the land in the previous year, and it had been kept *very closely grazed* down by stock, almost up to the time of

commencing the experiment. Thus, though the land of this field was undoubtedly of higher natural quality, and was probably also in a higher condition, so far as the influence of recent manuring was concerned, yet, owing to its herbage being so much more closely grazed down, it was in that respect in a less favourable condition for the first year's crop, and accordingly, in the first season, gave, without sewage, less produce than the other, though in succeeding seasons it gave much more. Indeed, whilst in the five-acre field the produce without sewage diminished from year to year, being even less in the second year than in the first, notwithstanding the much larger amount of rain, it was in the ten-acre field so very much larger in the second year than in the first, and so very much larger in both the second and third years in that field than in the other, that it was thought, until full inquiry had been made, that there must be some error either in the measurement of the land or in the records. None was, however, found; and the difference in the character and composition of the two soils, which subsequent examination showed, satisfactorily accounted for the great difference in their natural yield. For further information on this point see p. 63.

These few remarks on the character and condition of the land in the two fields will serve as some explanation of the proportionally much greater difference in the amounts of increase over the natural produce from a given amount of sewage, than in the amounts of total produce per acre, where the same amounts of sewage are applied in the different fields, or in different seasons. A few comments only need be made on the results themselves as recorded in the Table.

In the first season the sewage was not applied experimentally until March in the five-acre, and April in the ten-acre field, and hence the amounts of increase of produce yielded had to be reckoned as due to comparatively small quantities of sewage applied. Taking the average result of the two fields, the increase obtained for 1,000 tons of sewage applied, when reckoned as green grass, was rather more when the two larger than when the smallest quantity of sewage was applied per acre, but reckoned at one uniform condition of dryness as hay, it was slightly less with each increased amount of sewage applied.

In the wet and cold season of 1862, which was, of course, favourable for the unsewaged land, and by comparison the less appropriate the greater quantity of sewage applied, the amount of increase for 1,000 tons of sewage, whether reckoned as green grass or as hay, diminished considerably with each increase of sewage applied per acre. And notwithstanding the amounts of total produce per acre with equal quantities of sewage were not very different in the two fields, the amounts reckoned as increase for 1,000 tons of sewage applied were very much less in the ten-acre than in the five-acre field, owing to the much larger produce without sewage in the former.

In 1863 again, though a much warmer and more genial season for the action of sewage, there was still, though in a much less

degree than in 1862, a diminishing proportion of increase for 1,000 tons of sewage, the larger the quantity applied per acre. There was also, owing chiefly to the much larger produce without sewage, much less to be reckoned as increase for each 1,000 tons of sewage applied in the ten-acre than in the five-acre field.

It is worthy of remark, that although the produce per acre without sewage is so much the greater in the ten-acre field than in the other, it is with equal, but especially with the larger amounts of sewage, pretty uniformly the greater in the five-acre field. This result was doubtless partly due to its being better fitted, from its porosity, for sewage irrigation, but partly also to the fact, that whilst it was comparatively flat, allowing the sewage to pass over it more slowly and so to be better absorbed, the ten-acre field was in high ridges, and steeply inclined, rendering it difficult to prevent the water running over it too quickly. This point will be illustrated further on by reference to the comparative composition of the drainage water from the two fields.

Taking the average results of the three years, and the two fields, we have, with sewage applied at the rate of 3,000 tons per acre per annum a produce per acre of a little over 22¼ tons of green grass, equal rather more than 5 tons of hay; with 6,000 tons of sewage rather more than 30¼ tons of green grass, equal rather more than 5¾ tons of hay; and with 9,000 tons of sewage rather more than 32½ tons of green grass, equal about 6¼ tons of hay.

The largest quantities of produce reached were those obtained with the largest quantities of sewage (9,000 tons per acre per annum), and in the third year of the experiments, amounting in the five-acre field to 37 tons of green grass, equal rather more than 7 tons of hay, and in the ten-acre field to nearly 35 tons of green grass, equal nearly 6 tons 13 cwts. of hay.

The average increase of green grass over the natural produce for 1,000 tons of sewage applied was, with 3,000 tons of sewage per acre nearly 5 tons, with 6,000 tons of sewage rather more than 4 tons, and with 9,000 tons not quite 3¼ tons. Reckoned as hay, the average increase for 1,000 tons of sewage was, with 3,000 tons of sewage per acre 16 cwts., with 6,000 tons nearly 11 cwts., and with 9,000 tons 9¼ cwts. As, however, these average results relating to increase include those of the ten-acre field, where, owing to the very high natural produce, the amount reckoned as increase due to sewage was comparatively small, it is probable that results equal at any rate to those of the five-acre field may be expected in the average of cases elsewhere; and where, as may frequently happen, a soil which yields a very small natural produce, may, nevertheless, owing to its physical qualities, be well adapted for the application of sewage and give large amounts of produce per acre under its influence, the amounts of increase for a given amount of sewage applied may be even considerably higher than those obtained in the five-acre field.

The general result is, that there was much more total produce per acre with 6,000 tons of sewage than with 3,000, and more still

with 9,000; but that the increase for a given amount of sewage applied was less with 9,000 tons than with 6,000, and less with 6,000 than with 3,000.

The increase in the amount of produce with each increase in the quantity of sewage applied appears proportionally greater when reckoned as green grass than as hay. This is due to the much greater succulence, and, therefore, less proportion of dry substance in the more highly sewaged and heavier crops. The question arises, whether, with a less proportion of dry substance in the sewaged grass, a given weight of that dry substance will have a greater or a less value as food for stock than an equal weight from the less succulent unsewaged grass? This point will be fully considered in subsequent Sections of the Report.

II. *Experiments with Italian Rye-grass.*

In April 1863 arrangements were made with Mr. Campbell for gauging the sewage applied, and weighing and sampling the produce obtained, in a field of Italian rye-grass, and also for trying the feeding qualities of the grass. From the field in question, a crop of tares, which had been manured with farm-yard dung, had been carried off in the spring of 1862. The land was then cleaned, again manured with stable and farm-yard dung, and sown down with rye-grass in September (1862); and, at the time of commencing the experiment in the following Spring, there was a promising and tolerably even crop.

Three plots of about an acre each were set apart; plot 1 to be unsewaged; plot 2 to receive sewage at the rate of 3,000; and plot 3 at the rate of 6,000 tons per acre per annum. So meagre was the flow, however, that up to the end of October (1863) only 787 tons had been applied to plot 2, and 1,522½ tons to plot 3, instead of 1,512 and 3,057 tons, respectively, that were required according to the rates intended, reckoning from the date of the first application in the Spring.

The particulars of the amounts of sewage applied, and of the amounts of produce and increase obtained, reckoned both as green grass and in the condition of dryness of hay, are given in Table V., p. 17. Further details will be found in Appendix, Table V., pp. 97–100.

Table V.—Amounts of Sewage applied, and of Produce and Increase obtained, in Experiments on Italian Rye-grass.

Season 1863.

	Without Sewage.				With Sewage.							
	Plot 1.				Plot 2.				Plot 3.			
Sewage applied per Acre.												
					Tons.				*Tons.*			
April - - -	..				..				48·0			
May - - -	..				152·1				237·6			
June - - -	..				178·0				354·7			
July - - -	..				218·1				403·1			
August - -	..				120·8				163·4			
September - -	..				60·1				219·9			
October - -	..				58·1				75·9			
Total - - -	..				787·2				1522·6			
Rye-grass obtained per Acre, during each separate Month.												
	Tons	*cwts.*	*qrs.*	*lbs.*	*Tons*	*cwts.*	*qrs.*	*lbs.*	*Tons*	*cwts.*	*qrs.*	*lbs.*
April - - -	3	4	1	21	4	3	1	22	3	15	3	15
May - - -	1	17	2	23	–	–	–	–	1	11	1	7
June - - -	8	18	0	22	7	1	1	27	6	9	3	13
July - - -	–	–	–	–	5	16	3	21	6	10	2	21
August - -	2	0	1	13	1	14	1	13	3	0	2	10
September - -	0	9	2	7	0	13	1	6	1	12	0	11
October - -	0	6	0	9	1	5	3	16	2	3	0	12
	16	16	0	19	20	15	1	21	23	3	2	5
Rye-grass obtained per Acre, in each successive Crop.												
1st Crop - -	5	2	0	16	4	3	1	22	3	15	3	15
2d Crop - -	8	18	0	2	7	1	1	27	5	14	0	3
3d Crop - -	2	0	1	13	5	16	3	21	7	7	1	13
4th Crop - -	0	9	2	7	1	14	1	13	4	2	2	23
5th Crop - -	0	6	0	9	0	13	1	6	2	0	1	23
6th Crop - -	–	–	–	–	1	5	3	16	2	3	0	12
	16	10	0	19	20	15	1	21	25	3	2	5
Summary of Produce per Acre.												
Green Grass - -	16	16	0	19	20	15	1	21	25	3	2	5
Reckoned as Hay* -	4	18	3	8	5	5	0	16	5	12	2	11
Increase of Produce per Acre.												
As Green Grass -	..				3	19	1	2	8	7	1	14
Reckoned as Hay* -	..				0	6	1	8	0	13	3	3
Increase for each 1,000 Tons of Sewage applied.												
As Green Grass -	..				5	0	2	25	5	9	3	17
Reckoned as Hay* -	..				0	8	0	4	0	9	0	5

* The amount of hay to which the grass is equivalent is calculated by raising the amount of the experimentally determined perfectly dry or solid substance in the grass, in the proportion of from 84 to 100, on the assumption that the hay would contain 84 per cent. of dry substance and 16 per cent. moisture.

When the experiment with rye-grass was determined upon early in *April, the grass* was so far forward that it was found *necessary to take a first* cutting without sewage, before the

water-runs could be properly adapted for the separate irrigation of the respective plots, and hence but little sewage was applied before the end of April, and that little only on plot 3. The effect of the sewage was, therefore, as the second and third divisions of the Table show, to increase the produce chiefly during the later months and later crops of the season, and it did so very much in proportion to the amounts applied.

The total produce per acre was, without sewage (though otherwise pretty well manured), rather more than $16\frac{3}{4}$ tons, with 787 tons of sewage rather more than $20\frac{3}{4}$ tons, and with $1,522\frac{1}{2}$ tons of sewage nearly $25\frac{1}{4}$ tons of green grass; or, reckoned at a uniform condition of dryness as hay, the amounts were equivalent to 4 tons $18\frac{3}{4}$ cwts., 5 tons $5\frac{1}{4}$ cwts., and 5 tons $12\frac{1}{2}$ cwts. respectively. The increase of produce per acre was, therefore, nearly 4 tons of green grass due to the smaller, and about 8 tons $7\frac{1}{2}$ cwts. due to the larger application of sewage; though the increase in real dry substance represented only $6\frac{1}{4}$ cwts., and $13\frac{3}{4}$ cwts. of hay, respectively.

The increase reckoned for 1,000 tons of sewage in each case was, with the smaller quantity applied, 5 tons $0\frac{3}{4}$ cwts., and with the larger quantity, nearly 5 tons 10 cwts. of green grass; but the increase of real dry substance represented only 8 cwts., and 9 cwts. of hay, respectively. The increase in real dry or solid substance was, therefore, very small; but it will be seen further on that, at any rate in the case of the meadow grass (and it is probably the same with the rye-grass), a given amount of the dry substance of the sewaged produce was more productive of milk, and even slightly more of increase, than an equal amount of the dry substance of the unsewaged.

The general result is, that there was as much or more increase of green produce for 1,000 tons of sewage with the rye-grass than in most of the cases in the same season with the meadow-grass, where so very much larger quantities of sewage were applied, though the increase of dry substance reckoned as hay was generally the higher with the meadow-grass. That is to say, the comparatively large amounts of sewage applied to the meadow-grass gave, on the average, a larger amount of increase in dry or solid substance, for a given quantity of sewage, than the much smaller amounts applied to the rye-grass. It is also to be observed that there was a larger amount of increase, both of green grass and of dry substance reckoned as hay, for a given quantity of sewage on plot 3 with the larger, than on plot 2 with the smaller amount applied to the rye-grass. The facts point to the conclusion that, for the season in question, the larger quantity applied was below that required to yield the maximum increase for a given amount of sewage. It is obvious, however, that it may be advantageous even to pass this point; for, within certain limits, it will be economical to reduce the area and cost of distribution at the expense of a certain sacrifice of sewage.

It is to be regretted that the plant of rye-grass was so much *injured by frost* during the winter of 1863–4 (and it was the more

To face page 19.

TABLE VI.—Summary of the Results o

PLOTS, &c.	Consumed per Head per Day.				Consumed per 1,0 weight per		calculated sewage applied.	
	Fresh Food.		Dry Substance of Food.		Fresh Food.		Value of Increase in Live-weight from the increased Produce from 1,000 tons Sewage.	
	Grass.	Oilcake.	In Grass.	In Oilcake.	Grass.	Oilcake.	Including the Oilcake consumed (if any) -	Exclusive of Oilcake
Season								
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	£ s.	£
1. Unsewaged -	89·8	..	23·7	..	576	..	..	
2. Sewaged - -							..	
3. Sewaged - -	105·2	.	21·3	..	668	..	..	
4. Sewaged - -							..	
Season 1862 ; Reckoni								
1. Unsewaged	105·4	3·5	23·6	3·1	584	19·7	..	
2. Sewaged - -							3 8	
3. Sewaged - -	126·1	3·5	20·9	3·1	704	19·9	2 6	
4. Sewaged - -							1 8	
Season 1862 ; Reckoni								
1. Unsewaged -	100·9	3·7	23·9	3·3	535	19·5	..	
2. Sewaged - -							2 12	
3. Sewaged - -	123·2	3·7	20·9	3·3	658	19·7	1 15	
4. Sewaged - -							1 1	

* *The value of* the increase in live-weight, " exclusive of oilcake," is reckoned b… …of in…
weight, " *exclusive of oilcake*," by deducting from the gross increase with oilcake… …tton-cak…
a very much larger proportion of the cost was chargeable against the manure, and … …th.
† *This period* includes the first three weeks during which the two oxen, otherwis…
‡ *This period* excludes the first month of the experiment, during three weeks of…

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re the sewage had been the most liberally applied), that it ecessary to plough it up, otherwise the experiment would een continued through the season of 1864. Instead of this, was sown over the three plots without any further manure, was obvious to the eye during growth that the crop was heavier where sewage had been applied to the rye-grass than it had not, and heavier where the larger than where the r quantity had been applied.

III. *Experiments with fattening Oxen.*

in 1861, so in 1862, 10 oxen were purchased and tied up in to consume the grass from the five acre field; two to be unsewaged, and the remaining eight on sewaged grass; the to be cut, as ready, indiscriminately from the three sewaged In 1861, the animals had grass alone for the first 16 out 20 weeks of the whole experiment, and they had oilcake in n (four pounds per head per day) only during the concluding reeks. The object was to try grass alone in the first season, e result was very unfavourable. In 1862, oilcake was given ition to the grass from the commencement, in quantity which, ged over the whole period of nearly 23 weeks, amounted to 3½ lbs. per head per day.

e detailed records of the experiments in 1861 were given in ppendix to the last Report, and those of the experiments of will be found in Tables VI. to VIII., pp. 101–108, in the Ap- x to the present Report. Table VI. (opposite) summarises, and together at one view, the results obtained in 1861 on grass and those in 1862, on grass with oilcake in addition. The division of the Table relates to the experiments of 1861; iddle one to the whole period of experiment of 1862, ing the first four weeks during three of which the oxen edly on unsewaged grass, had (for want of supply) sewaged and the lower division represents the results exclusive of st month. Inasmuch as both lots increased very much more the first month than afterwards, the rate of increase on hole would appear comparatively small if that period were d; whilst, including it, included also the period of three during which the two oxen had sewaged grass. It was it better, therefore, to give the results both ways. The rison between the effects of the unsewaged and the ed grass is, however, much the same whichever period be d.

oth years a greater weight of the fresh sewaged grass was ned per head per day, and per 1,000 lbs. live-weight per than of the less succulent unsewaged grass; but the dry id substance contained in the larger amount of sewaged consumed was less than that in the unsewaged. Again, as in 1861, grass was given alone, more of the sewaged of the *unsewaged, reckoned* in the green or fresh state, *quired to produce 100 lbs.* increase in live-weight; though

the amount of dry substance contained in the sewaged grass so required was only about four fifths as much as that in the unsewaged grass. But when, as in 1862, a fair allowance of oilcake was given in addition, very much less both of fresh food and of dry or solid substance of food were required to produce 100 lbs. increase in live-weight than in 1861 with grass alone, and considerably less of the dry or solid substance of the more succulent sewaged than of the drier unsewaged grass was required.

It is also observable, that, reckoned in the green state, about the same amount both of the unsewaged and sewaged grass was consumed per 1,000 lbs. live-weight per week in 1862 with oilcake in addition, as in 1861 with grass alone; but the dry substance supplied in the grass consumed in 1862, with oilcake, was, both with the unsewaged and the sewaged grass, less than in 1861 without it.

The result in 1861, when cut grass was given alone, was extremely unsatisfactory, the amount of food required to produce a given amount of increase being unusually large, and the rate of increase on a given weight of animal within a given time unusually small. But when, in 1862, oilcake was given with the grass, and especially when given with the sewaged grass, very much better results were obtained. Indeed, in 1862, the rate of increase per 1,000 lbs. live-weight per week (if taken over the whole period of nearly 23 weeks) was, both with unsewaged and with sewaged grass (and oilcake in addition), about equal to the average obtained with animals of fair quality fed on good fattening food; but the food consumed for the production of 100 lbs. of increase, even in the case of the sewaged grass, contained more dry or solid substance than is usually required when oxen are liberally fed on oilcake, hay-chaff, and roots, and with the unsewaged grass considerably more. It should be borne in mind, however, that the experiment with unsewaged grass was on two animals only, whilst that with the sewaged was on eight, giving, therefore, a much more trustworthy average; and the results given in Appendix, Table VII. p. 107, show that one of the two oxen on unsewaged grass gave less increase than any of those on the sewaged, whilst the other gave considerably more than the average increase of the latter.

The general result is that the sewaged grass cut green and given to oxen tied up under cover, gave, when supplemented with a fair allowance of oilcake, a good average rate of increase in relation to the weights of the animals within a given time, and also a moderate rate of increase in relation to the amount of dry or solid substance provided in the food consumed.

It remains to say a few words on the last ten columns of Table VI.

It is seen that, by the aid of sewage, the time which an acre of land would provide food for an ox was increased three or more fold, varying according to the amount of sewage employed. Taking into account, however, the large amounts of oilcake consumed with the produce of each acre in 1862, it results

that (excepting on plot 2, where the produce was very much larger than in 1861) a given area would support considerably less stock in the cold and wet season of 1862 than in the more genial one of 1861.

The amount of increase in live-weight yielded from the produce of an acre was also increased several fold by means of sewage; about three-fold with the highest amount of sewage when the grass was consumed alone, and nearly four-fold in 1862, when oilcake was given in addition, in much about the same proportion to a given amount of the unsewaged and the sewaged grass.

It was shown in the last Report how very small was the gross money value of the increase in live-weight obtained from the consumption of the produce of an acre, or of the increased produce from 1,000 tons of sewage, when the grass was consumed alone, and the results then referred to are given in the upper division of the Table to compare with those in the lower divisions relating to 1862, when oilcake was also used. The result is seen to be, that the money value of the increase in live-weight from the produce of an acre of sewaged land, or from the produce of 1,000 tons of sewage, was very much greater in 1862, when oilcake was given, than in the corresponding cases in 1861 without it. The money return per acre was also from three to four times as great with sewage as without it, and although it is greater where 9,000 or 6,000 than where only 3,000 tons of sewage were applied, yet the return calculated, not per acre, but for each 1,000 tons of sewage, is, in each case, the less the greater the amount applied.

The next section of the Report will show that a very much higher money value was obtained both from an acre of land, and from a given amount of sewage, when the sewaged grass was employed for the production of milk instead of meat. But it may be mentioned that at Croydon, although the land is there more liberally sewaged than was the case in any of the Rugby experiments, satisfactory results have been obtained with fattening stock fed on the land. The practice there is, to irrigate for three or four days and nights together two or three times for each crop, and when the grass has got a sufficient head, to stop the application and turn the stock upon the land, where they remain until the grass is closely eaten down; they are then removed, the land is re-irrigated, and so on.

IV. *Experiments with Milking Cows.*

By the kindness of Mr. Campbell, experiments were made with his cows each year, 1861, 1862, and 1863, on the milk-yielding qualities of the grass.

In 1861, 12 of Mr. Campbell's cows were carefully selected and set apart to be fed on grass alone, 2 on unsewaged and 10 on sewaged grass, and the experiment was so conducted over a period of 16 weeks. It was afterwards continued for 4 weeks longer, *with an allowance of oilcake* as well as grass.

In 1862, 3 cows were selected to receive oilcake and unsewaged, and 12 oilcake and sewaged grass, and the experiment was continued for 24 weeks.

In 1863, 20 recently calved cows were selected, 5 to be fed on unsewaged meadow grass, 10 on sewaged meadow grass, and 5 on Italian rye grass. The design was to give each lot grass alone for the first 12 weeks, and afterwards a certain amount of oilcake in addition.

The detailed records of the experiments with cows in 1861 were given in the Appendix to the last Report; and those of the experiments in 1862 and 1863 will be found in Tables IX. to XIV., pp. 109–162, in the Appendix to the present Report. The results of all the experiments are given, in a condensed form, at one view, in Table VII. opposite.

Leaving the more detailed Tables for reference, to supply any further illustrations or explanations that may be needed, it will be sufficient to make a few comments on the main facts brought to view in the last-mentioned summary Table.

Reviewing the results of the experiments in which sewaged was tried against unsewaged meadow grass, it is observable that, excepting in the first season (1861), the cows required more both per head per day, and per 1,000 lbs. live weight per week, of the fresh or green sewaged than of the unsewaged grass; yet, the yield of milk, both per head and per 1,000 lbs. live weight, was, without exception, the greater with the unsewaged grass. The increase in live weight was also somewhat the greater on the unsewaged grass in 1861 and 1862, but the contrary was the case in 1863.

Reckoned in the fresh or green state in which it was cut and carted, there was, in fact, in every case but one (and then the quantities were equal), considerably less of the unsewaged than of the sewaged grass required to be consumed for the production of one gallon of milk. It should be remarked, however, that the unsewaged grass was generally cut in a much riper and less succulent condition, and therefore contained a considerably higher per-centage of dry or solid substance than the sewaged. It may be also here mentioned that in 1863 the cows having professedly unsewaged meadow grass, in default of a sufficient supply of it, had necessarily for a considerable part of each of the periods of 12 weeks unsewaged rye-grass.

Weight for weight, in the fresh or green state in which the grass was cut, weighed, and given to the cows, the unsewaged grass has, therefore, proved to be far more productive than the sewaged. But when the comparison is made, not between the amounts of grass reckoned in the fresh state, but between the amounts of dry or solid matter which the different descriptions of grass supplied, the result is that, in only one instance was there more, and in the others there was either an equal amount or even less of dry or solid substance of sewaged than of unsewaged grass required for the production of a given amount of milk.

The general result in regard to these points was, then, that in *both milk and* increase, but especially milk, a given weight of

TABLE VII.—[…]alian Rye Grass (Unsewaged and Sewaged),

Plots, &c.	Consumed per Acre.† Fresh Food. Grass.	Oil-cake.	…re …‡	Value of the Milk from the Produce of each Acre at 8d. per Gallon. Including the Oilcake consumed (if any).	Exclusive of Oilcake.‡	Results calculated per 1,000 tons Sewage applied.† Amount of Milk from the increased Produce from 1,000 tons of Sewage. Including the Oilcake consumed (if any).	Exclusive of Oilcake.‡	Value of the Milk from the increased Produce from 1,000 tons of Sewage at 8d. per Gallon. Including the Oilcake consumed (if any).	Exclusive of Oilcake.‡
	Lbs.	Lbs.	…s.	£ s. d.	£ s. d.	Gallons.	Gallons.	£ s. d.	£ s. d.
1. Unsewaged -	150·2	..		..	10 14 3	..	..	..	..
2. Sewaged -	194·0	..		..	19 0 5	..	179¾	..	5 19 10
3. Sewaged -				..	27 6 11	..	178	..	5 16 5
4. Sewaged -				..	32 0 10	..	151¾	..	5 0 11
1. Unsewaged -	127·2	3·5		22 4 5	20 8 10	..	..	..	..
2. Sewaged -	140·2	3·6		30 13 8	27 16 10	64¾	74	2 10 5	2 9 4
3. Sewaged -				35 15 2	32 8 11	67¾	60	2 5 2	2 0 0
4. Sewaged -				35 4 1	31 18 10	43¼	38¾	1 6 10	1 5 7
1. Unsewaged -	99·1	..		..	13 8 0	..	..	..	..
2. Sewaged -	142·9	..		..	33 19 5	..	205¾	..	6 17 2
3. Sewaged -				..	46 16 7	..	167¼	..	5 11 5
4. Sewaged -				..	51 9 5	..	126¾	..	4 4 7
1. Unsewaged -	90·5	3·9		14 16 3	14 7 6	..	..	..	..
2. Sewaged -	172·0	3·7		26 0 0	25 4 8	111¾	109¾	3 14 7	3 12 8
3. Sewaged -				35 16 9	34 14 11	105¾	101¾	3 10 1	3 7 11
4. Sewaged -				39 7 9	36 3 10	81¾	79¾	2 14 7	2 12 11
			Grass and Oilcake.						
1. Unsewaged -	95·4	1·7		13 19 7	13 16 0	..	..	..	..
2. Sewaged -	157·4	1·8		29 12 4	29 3 9	166¾	153¾	5 4 8	5 2 7
3. Sewaged -				40 16 6	40 4 7	134¾	132¾	4 9 6	4 8 1
4. Sewaged -				44 17 5	44 4 4	103	101¾	3 6 8	3 7 7
1. Unsewaged -	159·3	..		..	24 0 0	..	..	..	..
2. Sewaged -				..	29 13 3	..	215¾	..	7 3 11
3. Sewaged -				..	55 19 0	..	235¾	..	7 16 11
1. Unsewaged -	121·3	3·3		28 5 6	27 11 4	..	..	..	..
2. Sewaged -				34 18 11	34 1 5	254¾	247¾	8 9 6	8 5 3
3. Sewaged -				42 7 1	41 5 11	277¾	270¾	9 4 11	9 0 3
			…ye Grass and Oilcake.						
1. Unsewaged -	142·5	1·5		25 12 2	25 6 10	..	..	..	..
2. Sewaged -				31 13 0	31 6 5	230¼	227¾	7 13 5	7 11 11
3. Sewaged -				38 7 3	37 19 5	251¾	246¾	8 7 5	8 5 9

* In the preparation of this Table […]uring any part of a "Period" when, for want of a sufficient supply the animals received any other than […]es, the supply of which, as will be readily understood, was not so regular throughout the seasons as th[…]s on the unsewaged and those on the sewaged grass, although in point of fact the allowance, at paralle[…]

† In the experiments with meadow […] increase per 1,000 tons of sewage, in the two fields.

‡ The *value of the milk, "exclusive* […]lcake; and the *amount* of milk, "exclusive of oilcake," by deducting *from the gross amount of milk with* […]pe-cake and cotton-cake, were used, a very much larger proportion *of the cost was chargeable against th*[…]stimations to the truth.

animal was more productive when fed on unsewaged than on sewaged grass, and that a given weight of fresh unsewaged grass was more productive than an equal weight of fresh sewaged grass; but that a given weight of dry or solid substance supplied in sewaged grass was more productive than an equal weight supplied in unsewaged.

A careful consideration of the results leads to the conclusion that there was some considerable variation in the quality of the grass in the three different seasons. It was obviously very inferior in the wet and cold season of 1862. There is also evidence of a considerably diminished productiveness of a given weight both of green sewaged grass and of the dry substance of sewaged grass towards the end of the season; though part of the falling off which the figures show is doubtless attributable to the changing condition of the cows themselves as the season advanced.

The experiments do not afford the means of strictly comparing the productive qualities of rye grass with those of meadow grass, or of sewaged with those of unsewaged rye grass. Thus, as already alluded to, the cows professedly fed on unsewaged meadow grass in 1863 had, during a considerable part of the experimental period, unsewaged rye grass; whilst those fed on rye grass had indiscriminately the unsewaged and the sewaged. The indication is, however, that somewhat more of the dry substance of the sewaged rye grass than of the sewaged meadow grass was required to produce a given result; though the difference is less during the later than the earlier period of the season. It is probable, indeed, that sewaged Italian rye grass deteriorates less towards the end of the season than sewaged meadow grass.

It remains to indicate, approximately, the increased yield of saleable produce, and the money value of that produce, from an acre of land, and from 1,000 tons of sewage, according to season, and to the amount of sewage applied.

The last ten columns of Table VII. refer to these points. In explanation of the figures there given it should be stated, that the estimates of the amount, and value, of the milk yielded per acre, are, in the case of each plot, based upon the total amounts of grass obtained per acre throughout the season, and upon the average rate of consumption and yield of milk during each separate period, on unsewaged grass in the case of plot 1., and on the mixed sewaged grass in that of plots 2, 3, and 4; and the estimates are framed so as to show, as far as practicable, the amount and value, both inclusive and exclusive of oil-cake when it was given, as will be better understood by reference to the columns in the Table, and the foot note relating thereto.

It is obvious that such estimates can only be approximations to the truth. But such they are, and considered as such only, they are little likely to mislead any acquainted with practical agriculture, and with the limits within which such calculations are and are not of general application.

Referring first to the experiments with meadow grass, the result (excluding *the case of 1862,* when the unsewaged crop in the ten-

acre field was so very large) was, that the produce of an acre without sewage was competent to feed one cow for from 19 to 23 weeks, varying according to the season, or whether the grass were consumed alone or with oil-cake in addition. The same area was, with the aid of 3,000 tons of sewage, rendered capable of providing keep for two to two and a half cows for the same period of time; or, as represented in the Table, for one cow from two to two and a half times as long, with 6,000 tons of sewage for three to three and a half times as long, and with 9,000 tons from three and a half to four times as long.

Represented in quantity of milk, in 1861, when the sewage was not applied until the Spring, the produce per acre was, without sewage, 321¼ gallons, and with the different amounts of sewage 570¾, 820½, and 961¼ gallons, respectively. Reckoned according to the rate of consumption of grass and of the yield of milk during the first 12 weeks, or most favourable period, of the grass season of 1863, when, as in 1861, the grass was consumed alone, but unlike 1861 the sewage had been applied throughout the winter months, and when the cows being mostly newly calved were also in their most favourable condition, the estimated yield of milk reckoned upon the total produce of grass per acre was, without sewage 402 gallons, and with the different amounts of sewage 1,019, 1,404¾, and 1,544 gallons, respectively; or, so far as the sewaged plots were concerned, from one-half to two-thirds more per acre than in 1861 reckoned according to the rates of consumption and yield of milk over the whole of that season.

With the aid of the large quantities of oilcake stated in the Table, the yield of milk per acre in 1862, when the season was very favourable for the unsewaged but comparatively unfavourable for the sewaged land, was, without sewage 666½ gallons, and with the different amounts of sewage 920½, 1,072¾, and 1,056 gallons; and, according to the rates of consumption and yield of milk when oilcake was given during the latter half of the season of 1863, the yield of milk per acre calculated upon the total produce of grass throughout the season in each case was, without sewage 444¼ gallons, and with the different amounts of sewage 780, 1,075, and 1,181½ gallons respectively.

The general result is, that, on the sewaged plots, the yield of milk was at a less rate per acre with oilcake during the latter or inferior part of the season of 1863, than without it during the earlier or more favourable portion of the same season; but it was at much the same rates per acre during the latter or inferior part of the comparatively favourable season of 1863, as during the entire period of the unfavourable season of 1862. Lastly, on this point, the yield of milk per acre over the entire season of 1863, half without and half with oilcake, was higher than that of 1862 with oilcake throughout, and considerably so on the more highly sewaged plots.

So far as may be judged from the limited experience which these results record, it would appear probable that with an average supply of about 5,000 tons of sewage per acre per annum to meadow

ıd, and with cows taken indiscriminately at various periods after ving, an average of not less than 1,000 gallons of milk per re might be expected; or more than this when cows are taken their best, and the season and other circumstances are more than ually favourable.

In the case of the experiments with rye-grass much less wage was applied than is above assumed, and the results relate the experience of one season only, which was not only a comparatively favourable one for the action of sewage, but, being the st year of growth after sowing down, was also favourable so far the condition of the crop was concerned. The indication is, wever, that with Italian rye-grass a larger yield of milk per re may be obtained, for the application of a given amount of wage, than with meadow grass. But with Italian rye-grass the nd has to be periodically broken up, during which time less wage per acre, if any, can be utilized, and hence, for the distribution of a given amount of sewage, the expense of laying down much larger area would be necessary so far as this crop were ıtroduced. On the other hand, the advantage of the practice would be, that other crops, for which the direct application of sewage is less appropriate than to grass, would be intermediately grown, either relying upon the residue of sewage manuring remaining in the broken up land, or by means of the solid manure derived from the consumption of the sewaged grass. In either case, therefore, such produce would be obtained indirectly by means of sewage.

Bearing in mind the varying conditions of the several experiments, the differences which the Table shows in the estimated value of the milk yielded from the produce of each acre ostensibly receiving the same amount of sewage will be intelligible, and it will not be necessary to call attention to the figures in detail. The results taken as a whole lead to the conclusion that the gross money return per acre, reckoned in milk at 8*d.* per gallon, might be estimated at certainly not less than 30*l.* to 35*l.* with an application of about 5,000 tons of sewage per acre per annum.

No allowance can be made for the value of the increase in weight in the case of cows, for at the end of their milking period, even though some may gain in weight considerably, they are certainly, on the average, of less money value than at the beginning, so that a deduction rather than an addition should be made on the score of the difference in value of the animals themselves, at the end as compared with the beginning of their milking period.

The last four columns of Table VII. show the estimated yield of milk, and the value of the milk at 8*d.* per gallon, from the increased produce of 1,000 tons of sewage in the different experiments; and the estimates are given both inclusive and exclusive of oilcake (if any) as before referred to.

In 1861, when the sewage was not applied until the Spring, and less had therefore to be reckoned as contributing to the increase obtained, *nearly 180* gallons of milk are estimated to be

obtained for each 1,000 tons of sewage. when the amount actually applied had not exceeded 3,000 tons, and the rate per annum not 5,000. Again, reckoned according to the yield of milk for a given amount of grass consumed during the first 12 weeks, or the most favourable half, of the season of 1863, the increased yield of milk for each 1,000 tons of sewage was $205\frac{3}{4}$ gallons with 3,000, 167 gallons with 6,000, and only $126\frac{3}{4}$ gallons with 9,000 tons of sewage per acre per annum. According to the results obtained with rye grass during the same 12 weeks of the season of 1863, the yield was even somewhat better than in the most favourable case with the meadow grass, and it is the better the larger the quantity of sewage, which, however, was not applied until the Spring, and, owing to deficiency of supply, little exceeded 1,500 tons per acre.

Owing to the very large produce without sewage in 1862, and to the unfavourable character of the season for the action of sewage, the increased yield of milk estimated as due to 1,000 tons of sewage, even with the addition of a considerable amount of oilcake, was very small; much smaller, indeed, than in the more favourable seasons without the oilcake. It was also smaller with oilcake during the latter half of the season of 1863, than without it during the former half, when the quality of the grass, and the condition of the cows, were both so much more favourable. Even taking the whole of the comparatively favourable season of 1863, half without and half with oilcake, but when winter supply of sewage had to be reckoned against the produce, the estimated increased yield of milk for each 1,000 tons of sewage applied was consideraly less than in 1861 without oilcake, but when no winter supply of sewage had to be reckoned against the yield.

With rye-grass, unlike the meadow grass, the yield of milk for a given amount of sewage was greater during the latter part of the season with oilcake, than during the earlier or more favourable part without it. As before observed, it would appear that rye-grass does not deteriorate so much as meadow grass as the season advances.

In 1861, when no winter supply of sewage had to be reckoned against the increase, and the grass was consumed without oilcake, the estimated value of the milk obtained for each 1,000 tons of sewage applied was between *5l.* and *6l.* In 1863, according to the yield of milk for a given amount of grass during the first half of the season, without oilcake, the value for each 1,000 tons of sewage was, with 3,000 tons more, but with 6,000 and 9,000 tons less, than in 1861; and, reckoned according to the yield during the latter half of the season, it was, even with oilcake, little more than half as much as according to that during the earlier half; and in the unfavourable season of 1862, also with oilcake, it was even less still. Taking the whole of the comparatively favourable season of 1863, half without and half with oilcake, the return for each 1,000 tons of sewage, reckoned in milk at *8d.* per gallon, was rather over *5l.* when only 3,000 tons were applied, one seventh *less when 6,000 tons,* and one third less when 9,000 tons were *employed.*

With the rye-grass the estimated money return, for a given amount of sewage applied, was considerably higher than with the meadow grass; but it must be borne in mind that there was no winter supply of sewage to reckon against the produce, and that the results relate both to the first and most productive year of the growth of the crop, and to a favourable season for the application of sewage.

Excepting in the cases of the rye grass, and of the meadow grass in 1861, in neither of which had there been any winter supply, there was a very marked diminution in the money return for a given amount of sewage where the largest quantities were applied. The practical question suggests itself—what is approximately the limit of maximum yield for a given amount of sewage which is attainable without so far increasing the area, and consequently the cost of distribution, as to more than counterbalance the increased return? Special reference will be made to this point further on. But it may be here observed that, so far as these results give the means of judging, it would appear that an average of about 5*l.* increased value of milk, reckoned at 8*d.* per gallon, may be anticipated from the application of each 1,000 tons of sewage when the amount applied does not exceed about 5,000 tons per acre, per annum. This would be equivalent to a *gross* value of increased produce of milk of rather more than 1*d.* for every ton of sewage applied.

V. *Composition of the Rugby Sewage Water.*

From the commencement of the Rugby experiments, samples of sewage have been collected for analysis at short intervals in each of the two fields. The plan was, to take about a quart from the gauge tank in the field, holding about 3½ tons, at intervals of about two hours for as many days in the week as the sewage was applied; and at the end of the week, after well shaking the mixture, a one or two gallon sample was sent to Professor Way for analysis.

In 1861, twelve such samples from each field, representing the supply for the seven months of April to October inclusive, were taken and submitted to analysis.

The season of 1862 is reckoned to include the months from November 1861 to October 1862 inclusive. During each month from November 1861 to April 1862 inclusive only one sample was taken from each field, during May two, during June one, and during July, August, September, and October, two were taken; thus making a total of 17 samples from each field to represent the sewage supplied during the season.

In like manner the season of 1863 was reckoned to include the period from November 1862 to October 1863 inclusive. From November 1862 to March 1863 inclusive two samples of sewage were taken in each month in each field; in April one only in each field, and in May two in the 5-acre, and one only in the 10-acre field. From this date, namely, during June, July, August, September, and October, a different plan of collection

was adopted. During two weeks in each of these months (as a rule the first and third) a sample was taken every two hours from the gauge-tank in whichever field the sewage was being applied, and at the end of the week the samples from the two fields were well mixed, and a portion of the mixture sent off for analysis, as representing the sewage of that week, without distinction as to the field in which it was collected.

The results of each of the 24 analyses of the sewage representing the season ending October 1861 were given in the Appendix (and a summary of them was given in Table VI.) in the previous Report; those of the 34 for the season ending October 1862 are given in Tables XV. to XVII., and those of the 35 relating to the season of 1863 ending October 1863, in Tables XVIII. to XXI., pp. 163–169, in Appendix No. 1. in the present Report.

Leaving the details for reference it will be sufficient to give in this place the summary view of the composition of the sewage which Tables VIII. and IX. (pp. 29 and 30) present; in the former of which is given the average grains per gallon, and in the latter the average lbs. per 1,000 tons, of the different constituents, in the sewage from each field, in each of the three seasons, respectively.

Table VIII.—Average Composition of the Rugby Sewage, supplied in each Field, in 1861, 1862, and 1863

Grains per Gallon.

Constituents.		Season 1861; April to October.		Season 1862; November 1861 to October 1862.		Season 1863; November 1862 to October 1863.		General Means of			
		5-acre Field; 12 Samples.	10-acre Field; 12 Samples.	5-acre Field; 17 Samples.	10-acre Field; 17 Samples.	5-acre Field; 23 (1) Samples.	10-acre Field; 22 (2) Samples.	24 Samples; April to October 1861.	34 Samples; November 1861 to October 1862.	35 (3) Samples; November 1862 to October 1863.	93 Samples; April 1861 to October 1863.
Organic matter	In solution	10·26	10·30	8·42	7·98	8·35	8·29	10·28	8·20	7·92	8·63
	In suspension	16·75	11·57	16·71	16·96	27·35	25·99	14·16	16·84	24·03	18·85
	Total	27·01	21·87	25·13	24·94	35·70	34·28	24·44	25·04	31·95	27·48
Inorganic matter	In solution	36·82	35·85	35·00	33·83	39·57	38·77	36·34	34·42	36·80	35·81
	In suspension	16·18	12·55	21·31	20·42	39·41	34·93	14·36	20·86	34·45	24·30
	Total	53·00	48·40	56·31	54·25	78·98	73·70	50·70	55·28	71·25	60·11
Total in solution		47·08	46·15	43·42	41·81	47·92	47·06	46·63	42·62	44·72	44·44
Total in suspension		32·93	24·12	38·02	37·38	66·76	60·92	28·52	37·70	58·48	43·15
Total solid matter		80·01	70·27	81·44	79·19	114·68	107·98	75·14	80·32	103·20	87·59
Ammonia	In solution	4·99	4·98	4·45	4·51	5·83	5·69	4·98	4·48	5·22	4·89
	In suspension	1·65	1·18	1·45	1·48	2·08	1·98	1·41	1·47	1·86	1·60
	Total	6·64	6·16	5·90	5·99	7·91	7·67	6·39	5·95	7·08	6·49

(1) 13 Samples exclusively from the 5-acre Field, and 10 of mixtures from the 5-acre and the 10-acre Fields.
(2) 12 Samples exclusively from the 10-acre Field, and 10 of mixtures from the 5-acre and the 10-acre Fields.
(3) 13 Samples exclusively from the 5-acre Field, 12 from the 10-acre Field, and 10 of mixtures from the two fields.

Table IX.—Average Composition of the Rugby Sewage, supplied in each Field, in 1861, 1862, and 1863.

Lbs. per 1,000 Tons.

Constituents.	Season 1861; April to October.		Season 1862; November 1861 to October 1862.		Season 1863; November 1861 to October 1863.		General Means of			
	5-acre Field; 12 Samples.	10-acre Field; 12 Samples.	5-acre Field; 17 Samples.	10-acre Field; 17 Samples.	5-acre Field; 23 (¹) Samples.	10-acre Field; 22 (²) Samples.	24 Samples; April to October 1861.	34 Samples; November 1861 to October 1862.	35 (³) Samples; November 1862 to October 1863.	93 Samples; April 1861 to October 1863.
Organic matter — In solution	328·3	329·6	269·6	255·4	267·2	265·3	329·0	262·4	253·4	276·2
Organic matter — In suspension	556·0	370·2	534·7	542·7	875·2	831·7	463·1	538·9	769·0	603·2
Organic matter — Total	884·3	699·8	804·3	798·1	1142·4	1097·0	792·1	801·3	1022·4	879·4
Inorganic matter — In solution	1178·2	1147·2	1150·0	1082·6	1266·2	1240·6	1162·9	1101·4	1177·6	1145·9
Inorganic matter — In suspension	517·8	401·6	651·9	653·4	1261·1	1117·8	459·5	667·5	1102·4	777·6
Inorganic matter — Total	1696·0	1548·8	1801·9	1736·0	2527·3	2358·4	1622·4	1768·9	2280·0	1923·5
Total in solution	1506·5	1476·8	1389·5	1338·0	1533·4	1505·9	1491·9	1363·8	1431·0	1422·1
Total in suspension	1063·8	771·8	1216·6	1196·1	2136·3	1949·5	922·6	1206·4	1871·4	1380·8
Total solid matter	2580·3	2248·6	2606·1	2534·1	3669·7	3455·4	2414·5	2570·2	3302·4	2802·9
Ammonia — In solution	159·7	159·4	143·4	144·3	186·6	182·1	159·4	143·4	167·0	156·5
Ammonia — In suspension	52·8	37·7	46·4	47·4	66·5	63·4	45·1	47·0	58·5	51·2
Ammonia — Total	212·5	197·1	189·8	191·7	253·1	245·5	204·5	190·4	225·5	207·7

(¹) 13 Samples exclusively from the 5-acre Field, and 10 of mixtures from the 5-acre and the 10-acre Fields.
(²) 12 Samples exclusively from the 10-acre Field, and 10 of mixtures from the 5-acre and the 10-acre Fields.
(³) 13 Samples exclusively from the 5-acre Field, 12 from the 10-acre Field, and 10 of mixtures from the two fields.

As the ammonia contributes about three fourths of the estimated money value of the constituents of town sewage, and as its amount is the best index to that of the associated constituents valuable as manure, and also to the relation of population to quantity of sewage, its proportion is of great importance to consider.

Tables VIII. and IX. show that, according to the mean of all the analyses for the entire season in each case, there was comparatively little difference in the amounts either of ammonia, or of total matters in solution, in the sewage from the two fields. The difference in the amounts of suspended matter was, however, more considerable.

Comparing the composition of the sewage of one season with that of another, as indicated by the mean result of all the analyses relating to each, it is seen that the amounts of ammonia, and total matter in solution, are less in the comparatively wet season of 1861–2, than in either of the others, whilst the ammonia is the highest in the dry season of 1862–3. As no samples were analysed during the winter of 1860–61 when the sewage was probably weaker than during the remaining portions of the season, it might be concluded that the mean of the analyses for 1861 would give too high an average composition; but, on the other hand, there were fewer analyses during the months of August, September, and October, when the sewage was comparatively strong, than during the five preceding months when it averaged much weaker, which, of course, would tend to reduce the mean. It is probable, therefore, that the mean of the analyses for 1861 gives a pretty fair indication of the composition of the sewage for that season. With regard to 1862, there were fewer analyses during the months when the sewage averaged the strongest, and hence, the mean of the results for that season probably indicate somewhat too low an average composition. Lastly, in the season of 1863, there were again fewer analyses relating to the periods when the sewage was strongest, and hence the mean of the results for that season also probably indicates somewhat too low a composition. There can be little doubt, however, that the sewage of the wet season of 1862 was the weakest, that of 1861 somewhat stronger, and that of the dry season of 1863 stronger still.

It is obvious that the variations in the composition of sewage must depend chiefly upon its state of dilution, and that the state of dilution must be very much influenced by the rainfall. An inspection of the Tables in the Appendix, above referred to, will show how extremely different was the composition at one time compared with another, notwithstanding the general agreement of the average results as between one field and the other, or between one season and another. The great variation in the composition according to circumstances is strikingly illustrated in the following Table X.; and it is the more remarkable when it is borne in mind that every sample analysed was a mixture of portions taken every few hours *throughout* the day for several days together:

TABLE X.—Showing the highest, lowest, and average Amounts of Ammonia, and total solid matter, in mixed Samples of Sewage, collected at different Periods in each of the three Seasons.

—	—	Ammonia.		Total solid matter.	
		Grains per Gallon.	lbs. per 1,000 Tons.	Grains per Gallon.	lbs. per 1,000 Tons.
1861	Highest - -	15·64	500·5	216·5	6928
	Lowest - -	2·99	95·7	37·6	1203
	Mean of 24 analyses	6·39	204·5	75·1	2405
1861–2	Highest - -	11·38	364·2	129·3	4138
	Lowest - -	2·55	81·6	50·5	1616
	Mean of 34 analyses	5·95	190·4	80·3	2570
1862–3	Highest - -	12·81	409·9	269·9	8637
	Lowest - -	3·14	100·5	62·2	1989
	Mean of 35 analyses	7·08	226·5	103·2	3302

Thus, the amount of ammonia, which to such a great extent rules the estimated money value of the sewage, varied at different times during the 31 months to which the samples refer, from about 2½ to about 15½ grains per gallon, or from 81½ to 500½ lbs. per 1,000 tons; and the total solid matter varied from about 37½ to about 270 grains per gallon, or from 1,203 to 8,637 lbs. per 1,000 tons. It will be obvious from these results how valueless for the purposes of determining the average composition of the sewage of any locality—indeed, how utterly misleading—must be the analyses of samples taken without due regard to the circumstances by which its composition is so materially affected.

Although the sewage of 1862–3 was considerably richer in valuable constituents than that of the wetter season of 1861–2, yet the mean of the whole 93 analyses relating to the sewage of the three seasons indicates a composition closely agreeing, in all essential points, with that adopted in the previous report according to the results then obtained relating to the season of 1861 alone. For reasons explained above, however, the real average composition of the sewage of the period was probably somewhat higher than is indicated by the direct numerical mean of the 93 analyses. The latter gives—

	Grains per gallon.	Lbs. per 1,000 tons.
Total solid matter - -	87·6	2,803
Ammonia - -	6·5	208

From a careful consideration of the circumstances alluded to it is concluded that the average sewage of the 31 months would more nearly contain as follows—

	Grains per gallon.	Lbs. per 1,000 tons.
Total solid matter - -	92·5	2,960
Ammonia - - -	7·0	224

Assuming this to represent the average composition of the Rugby sewage during the period in question, 1,000 tons may be estimated to contain nitrogen reckoned as ammonia equivalent to that con-

tributed in the mixed excrements, and associated matters, of between 17 and 18 persons of a mixed population of both sexes and all ages in a year, or to that in between 11 and 12 cwts. of Peruvian guano.* In other words, about 1,700 tons of such sewage would contain nitrogen reckoned as ammonia equal to that in 1 ton of Peruvian guano. Yet it has been seen that the increase of grass obtained by the use of 1,000 tons of this sewage did not, under the most favourable circumstances, exceed that which would correspond to about 26 cwts. of hay, and was on the average much less. To this question of the amount of produce obtained for a given amount of manurial constituents applied further reference will be made.

Before leaving the subject of the composition of the Rugby sewage, attention should be directed to one or two other points.

In Table XI. are given the results of the analyses of samples of sewage collected in each of the two fields, every two hours from 7 a.m. to 5 p.m., on April 16, 1861. It is seen that the amounts of both total solid matter and ammonia were the least in the samples collected early in the morning, the greatest during the middle of the day, and diminished towards the evening. As, however, the samples were not taken at the outfall as the sewage came from the town at the respective hours, but after it had been pumped from the main tank in which it was being collected and mixed throughout the day as it was produced, the variations in composition at the different periods are not so striking as have been observed when samples have been collected directly from the outfall at different periods of the day.

Table XI.

Showing the Composition of Samples of the Rugby Sewage collected at different hours of the day, on April 16, 1861.

—		Per Gallon.			
		Organic matter.	Inorganic matter.	Total solid matter.	Ammonia.
		Grains.	Grains.	Grains.	Grains.
7 A.M.	Five-acre Field	14·30	38·50	52·80	2·74
	Ten-acre Field	14·40	38·90	53·30	2·89
9 A.M.	Five-acre Field	20·50	39·80	60·30	4·71
	Ten-acre Field	20·20	47·20	67·40	3·51
11 A.M.	Five-acre Field	21·90	38·00	59·90	5·14
	Ten-acre Field	22·70	39·60	62·30	5·39
1 P.M.	Five-acre Field	20·10	36·40	56·50	4·82
	Ten-acre Field	25·20	41·60	66·80	5·74
3 P.M.	Five-acre Field	21·10	34·10	55·20	4·55
	Ten-acre Field	21·50	35·30	56·80	4·69
5 P.M.	Five-acre Field	22·00	35·80	57·80	4·32
	Ten-acre Field	20·30	37·50	57·80	4·37

* The rainfall of the period of the experiments, and, therefore, the dilution of the sewage, was, however, less than the average, according to which it is estimated that, with the present arrangements, 1,000 tons would represent the excretal matters of scarcely 17 average individuals, and the ammonia of scarcely 11 cwts. of Peruvian guano. (See pp. 44–45, and 76.)

Another point to which reference should be made is as to the amounts of phosphoric acid and potass in the sewage, and the relation of these to the ammonia (or nitrogen) associated with them; for it is obviously important to consider whether or not the mineral or incombustible constituents of sewage exist in it in sufficient proportion to the ammonia or nitrogen for the requirements of the crops to be grown; and as the phosphoric acid and potass (the one or the other or both according to circumstances) are, perhaps, the mineral constituents the most likely to be deficient relatively to the nitrogen, the proportion of them to the latter in the sewage, and in various crops, may appropriately be referred to in illustration of the point in question.

Table XII. shows the number of grains per gallon, of ammonia, phosphoric acid, and potass, and the relation of the phosphoric acid and the potass to one of nitrogen, in the few cases only in which the phosphoric acid and potass were determined in the Rugby sewage.

TABLE XII.

Particulars of the Samples.		Per Gallon.			Proportion to 1 Nitrogen.	
When collected.	Where collected.	Ammonia.	Phosphoric Acid.	Potass.	Phosphoric Acid.	Potass.
		Grains.	Grains.	Grains.		
April 1–6, 1861 - -	Five-acre field	2·99	0·64	0·86	0·26	0·35
„ 1–6, „ - -	Ten-acre field	4·69	0·70	0·61	0·18	0·16
„ 29,—May 4, 1861 -	Five-acre field	5·08	1·09	1·37	0·26	0·33
„ 29,— „ 4, „ -	Ten-acre field	5·64	1·28	1·20	0·28	0·28
Nov. 4–6, 1861 - -	Five-acre field	10·91	2·14	4·95	0·24	0·55
„ 5, „ - -	Ten-acre field	11·38	2·39	4·63	0·28	0·49
Dec. 17–18, „ - -	Five-acre field	9·30	1·53	3·28	0·20	0·43
„ 17, „ - -	Ten-acre field	7·67	1·15	3·40	0·18	0·54
July 6–11, 1864 - -	Another field	8·66	3·12	3·84	0·44	0·54
„ 13–18 „ - - -	Another field	8·78	2·80	3·90	0·39	0·54
	Average -	7·51	1·68	2·81	0·27	0·42

It is seen that when the sewage was poor in ammonia it was also poor in phosphoric acid and potass, and when rich in ammonia rich in phosphoric acid and potass. In the case of neither constituent, however, is the relation to one of nitrogen the same in all the samples; though the correspondence is perhaps quite as close as could be expected when the circumstances which rule the amount of each are taken into consideration.

By far the larger proportion of the ammonia (or nitrogen) exists in solution in the sewage, so that if the sample taken did not contain its fair proportion of suspended or sedimentary matter, the amount of ammonia would not be very materially affected thereby. Of the phosphoric acid, on the other hand, a much larger proportion exists in the suspended matter, so that if the agitation in the main tank were incomplete, the pumps worked sluggishly, or the mixing in the gauge-tank in the field before taking the sample were insufficient, the proportion of suspended matter in the sample analysed might be too small, or under other conditions it might be too large. Hence, although the phosphoric acid must bear a pretty constant proportion to the nitrogen in sewage, i

great care be not taken in the sampling, analysis may show considerable variation in the amount, and in the proportion to the nitrogen, in samples taken at different times. It was, in fact, the case, that in the instances among those to which Table XII. refers in which the amount of phosphoric acid, and its proportion to the nitrogen, were the highest, there also was the largest amount of sedimentary matter in the sewage.

Again, the potass exists exclusively in the solution, so that if its proportion to the ammonia were constant in sewage, any deviation from the exactly due proportion of sedimentary matter in the sample taken would comparatively little affect the indications of analysis in regard to it. But whilst the phosphoric acid of sewage may be said to be derived exclusively from food-refuse and excretal matters, and therefore necessarily to bear within comparatively narrow limits a pretty uniform relation to the nitrogen, the amount of potass will vary very much according to locality, and be considerably greater where the streets or roads are constructed of potass minerals (as granite) than elsewhere.

According to the average result obtained upon the analysis of ten different samples of the Rugby sewage there were, as is shown in the bottom line of Table XII., 0·27 parts of phosphoric acid, and 0·42 parts of potass, to 1 of nitrogen in the sewage; or, in other words, for 100 of nitrogen in the sewage there were 27 parts of phosphoric acid, and 42 parts of potass. The question arises—what are the proportions of the phosphoric acid and potass to the nitrogen in different crops? These vary considerably for the same description of crop according to circumstances, but the figures given in the following Table (XIII.) may be taken to represent approximately the average proportions.

TABLE XIII.

—	Proportion to 1 Nitrogen.					
	Phosphoric Acid.			Potass.		
	In Corn, Roots, &c.	In Straw, Leaves, &c.	In Total Produce.	In Corn, Roots, &c.	In Straw, Leaves, &c.	In Total Produce.
Wheat	0·48	0·42	0·46	0·28	1·08	0·57
Barley	0·40	0·34	0·38	0·34	1·26	0·60
Oats	0·28	0·37	0·30	0·25	1·55	0·65
Meadow Hay . . .	..	..	0·27	..	..	1·00
Clover Hay . . .	..	..	0·23	..	..	0·52
Beans	0·25	0·46	0·30	0·32	1·23	0·50
Mangolds . . .	0·17	..	..	1·00	..	..
Swedes	0·27	0·16	0·21	0·82	0·44	0·63
Common Turnips . .	0·28	0·18	0·26	1·60	0·71	1·17
Potatoes	0·42	..	..	1·23	..	..

Thus, according to this Table, meadow hay contains on the average 0·27 parts of phosphoric acid to 1 of nitrogen, and according to the average result obtained on the analysis of the ten samples of the Rugby sewage it contained exactly the same proportion. Of potass, on the other hand, whilst meadow hay contains 1 part, the sewage only contained 0·42 parts to 1 of nitrogen.

According to these figures, if on the application of sewage to meadow land the whole of the nitrogen supplied were recovered in the increase of produce, it is obvious that there would be associated with it in the manure almost exactly the amount of phosphoric acid, but less than half the amount of potass, required by the crop. But in practice considerably less nitrogen is recovered in the increase of crop than is supplied in the manure employed to produce it. Then, again, the dry or solid substance of sewaged grass, as it is generally cut, contains a considerably higher per-centage of nitrogen than that of ordinary meadow grass as cut for hay; whilst, from the results of direct experiments made on the point, it is probable that the proportion of phosphoric acid to 1 of nitrogen is somewhat lower, and that of potass somewhat higher, in sewaged grass than in ordinary meadow hay. It follows, that if the relation of the phosphoric acid and potass to the nitrogen in sewage be fairly represented by the average result of the few analyses given on the point, it would contain more phosphoric acid, though perhaps not so much potass as could be turned to the account of growth under the influence of the amount of nitrogen at the same time supplied.

Of phosphoric acid at any rate there would probably be an accumulation within the soil, rather than an exhaustion of it, by the use of sewage to grass land. Still, agricultural experience shows that an apparently excessive supply of phosphoric acid is frequently useful in giving a favourable development, or tendency of growth, to a plant; and in this way it is possible that the application of phosphatic manures in conjunction with sewage might be advantageous. As above stated, the proportion of the potass to the nitrogen in town sewage would vary considerably according to locality; and where there was no other source of it than food-refuse and the excretal matters of man and animals, it would be more likely than the phosphoric acid to be in relative defect in case of the constant application of the sewage to grass land.

In corn crops, such as wheat or barley, the proportion of phosphoric acid to nitrogen is much higher than in meadow hay, and much higher also than was found in the Rugby sewage. The average proportion in the sewage was, however, not deficient compared with that of the phosphoric acid in these crops to the amount of nitrogen which in common practice is required to be supplied in manure, to yield one of nitrogen in the form of *increased produce.* Of potass, the proportion to 1 of nitrogen in

these crops is, in the grain, which alone is generally sold off the farm, considerably less than was found on the average in the Rugby sewage. In fact, if town sewage were used on any comprehensive scale to corn crops grown in rotation, phosphoric acid would be more likely to become deficient than potass in the majority of soils; but if phosphatic manures were employed for other crops of the course, they would not need to be supplemented to the sewage for corn. It is, indeed, well known that phosphatic manures are in practice much more used, and are much more effective, for root than for corn crops, yet, as the Table shows, the proportion of phosphoric acid to 1 of nitrogen is lower in the root than in the corn crops.

Without further comments on the figures given in Tables XII. and XIII., it may be stated, in general terms, that a careful consideration of the subject leads to the conclusion that potass would be more likely than phosphoric acid to become deficient where town sewage was applied constantly to meadow land, whilst phosphoric acid would be more likely to become deficient than potass where it was applied to the ordinary crops of rotation.

VI. *Estimated Average Composition of the Metropolitan Sewage.*

It will be well to offer a few observations here on the evidence at command relating to the average composition of the Metropolitan sewage, and to the estimated money value, according to trade prices, of its manurial constituents.

In our former Report attention was called to the fact that, so far as it was then sampled and analysed, the Rugby sewage showed an average composition agreeing very closely with that calculated for the Metropolitan sewage, according to the analyses by Dr. Letheby of samples, taken at noon and midnight respectively, from 10 different sewers; and, as above stated, the further results now at command indicate pretty nearly the same average composition for the Rugby sewage as that formerly adopted. Thus, whilst calculated according to Dr. Letheby's analyses the Metropolitan sewage contained 6·66 grains of ammonia per gallon, the Rugby sewage was then estimated to contain 6·65 grains, and taking into the calculation all the results now obtained the direct mean of the 93 analyses gives 6·5 grains, and the calculated average about 7 grains.

The amount of ammonia will still, for convenience, be taken as the gauge of comparative value; not, of course, that other constituents are not equally important, but, as already referred to, as the amount of ammonia contributes a very large proportion of the money value as estimated according to composition, and is a pretty sure indication of the approximate value of the associated constituents, it comes to be a very safe index to the approximate value of the whole, and at the same time the discussion is much simplified.

Baron Liebig, adopting as his basis an analysis of Dorset Square sewage by Mr. Way, which showed nearly 18 grains of

ammonia per gallon, estimates the constituents in sewage of that composition to be worth $1\frac{1}{3}d.$ per ton, but that the value will be raised to about $4d.$ if to each ton be added $1\frac{1}{5}$ lb. of superphosphate of lime. But in his report Professor Way stated in reference to the analysis in question, together with another given at the same time, that although the results showed that there was great manurial value in sewage, yet they could not be taken as in any way affording a measure of that value; and he has since given it as his opinion that the sample of sewage, upon the analysis of which Baron Liebig relied, was undoubtedly very much stronger than the average of Metropolitan sewage. Indeed, Baron Liebig himself admitted that more certain data as to the average composition of sewage were wanting. He said, "In the calculation of the value of sewer water there is one factor doubtful, viz., the absolute amount of phosphoric acid, ammonia, and potass, which a ton of the said water contains." Moreover, his proposal to add a certain quantity of superphosphate of lime to the sewage has for its object to assimilate the proportion of phosphoric acid to the ammonia or nitrogen in the sewage to that found in Peruvian guano, which, of course, is a standard having no necessary connexion with the proportions required by soils or crops. For these reasons Baron Liebig's estimates are obviously irrelevant.*

In the Report of Messrs. Hofmann and Witt to the Main Drainage Referees, they record 8·21 grains of ammonia per gallon as the amount they found in a mixture of samples of sewage collected from the Savoy Street sewer every hour during 24 in dry weather; and the Referees had ascertained by gauging that the rate of flow from the sewers under such circumstances averaged as closely as could be expected that which would be due to water supply exclusive of rainfall. In fact, the Referees concluded that the mixed sample in question represented pretty closely the average normal sewage without rainfall of that sewer, and further, that the sewage from that sewer might be taken as fairly representing the Metropolitan sewage under the conditions stated.

With 8·21 grains of ammonia per gallon (and the associated matters), Messrs. Hofmann and Witt estimated the constituents in a ton of such sewage to be worth $2\frac{1}{10}d.$, and taking (in accordance with the information supplied to them by the Referees) the total amount of the Metropolitan sewage without rainfall at 95 million gallons a day, or about 158 million tons per annum, they estimated the total annual value of the constituents in the Metropolitan sewage to be 1,385,540*l.*

To control this estimate founded on the amount and composition of the sewage, Messrs. Hofmann and Witt calculated the value of the constituents annually voided in the forms of urine

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* In a recent letter, published some time after the above was in type, Baron Liebig adopts 7·2 instead of 18 grains, as the average amount of ammonia in a gallon of the *Metropolitan* Sewage, *inclusive of rainfall*, &c. It will be seen, by the sequel, that *even after this* very liberal amendment of his estimate of about a year and a half ago, *he is doubtless still* too high; and his estimate of value of constituents is so in *corresponding* degree.

and fæces by the entire Metropolitan population, assuming it to number 2,600,000 persons. In this way they arrived at a value of 1,444,177*l*., which they considered satisfactory confirmation of the estimate deduced from the quantity and composition of the sewage. But in their confirmatory estimate they adopt, for the composition and value of the liquid and solid voidings of each individual of a mixed population of both sexes and all ages, the amounts fixed for adult males,* assuming that other matters reaching the sewers would probably make up the difference. There can be little doubt that this was making far too liberal an allowance for the other matters than human voidings, which contribute to the value of the Metropolitan sewage.

The object of the Referees appears to have been to obtain an estimate of the total annual value of the sewage, and with such very great variations as occur in both the amount and composition of the sewage when mixed with different amounts of rainfall, it is obvious that the method they adopted of collecting for analysis samples of sewage as far as possible free from rainfall, and then calculating the composition and value of the estimated total amount of dry weather sewage according to the results of the analysis of such samples, was the only admissible one unless they had taken samples almost the year round. Their estimate of the value per ton of the dry weather sewage, or sewage without rainfall, was, in fact, only a step in the process of calculating the total annual value of the Metropolitan sewage, and they did not give any estimate of the value per ton in the average condition of dilution with rainfall in which it would have to be utilized.

It is variously estimated that the normal sewage, or sewage without rainfall, is on the average the year round mixed with from two thirds to an equal bulk of subsoil water and rain. Assuming it to be so diluted by an addition of two thirds to its own bulk, this, adopting Messrs. Hofmann and Witt's analysis and valuation for the sewage without rainfall, would reduce the average amount of ammonia in the total sewage with rainfall to 4·93 grains per gallon, and it would in like manner reduce the value from $2\frac{1}{10}d.$ for a ton of sewage without rainfall to $1\frac{1}{4}d.$ for a ton inclusive of rainfall.

It is obviously important to consider whether the sample of the Savoy Street sewage analysed by Messrs. Hofmann and Witt was more probably of above or below the average composition and value of the Metropolitan sewage without rainfall? Some judgment may be formed on this point by a careful consideration of the quantity and estimated value of the constituents contributed to the sewage by each individual of a mixed population of both sexes and all ages, taken in connexion with the amount of water through which the constituents are supposed to be on the average distributed.

According to the data of Messrs. Hofmann and Witt the amounts of total solid matter, and ammonia, and the value of

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**Messrs. Hofmann and Witt* even add something to the actual experimental results *obtained with Hessian soldiers* to adapt them, as they say, to "John Bull"!

the constituents, in the annual total voidings of an adult male are as follows:—

Adult males, per head per annum.

	Total solid matter.	Ammonia.	Value.
	lbs.	lbs.	*s.* *d.*
Urine - -	61	15·8	10 0½
Fæces - -	34	2·3	1 8¾
Total -	95	18·1	11 9¼

Dr. Thudichum, whose estimate is more recent, and whose experimental data on the point are much more comprehensive than those relied upon by Messrs. Hofmann and Witt, gives for the urine alone of adult males the following:—

Adult males, per head per annum.

	Total solid matter.	Ammonia.	Value.
	lbs.	lbs.	*s.* *d.*
Urine alone -	47	15·9	10 3½

It will be observed that so far as the important items of ammonia and value are concerned, the estimates of Messrs. Hofmann and Witt for the urine of an adult male agree very closely with those of Dr. Thudichum, founded on much more comprehensive analytical data. Dr. Thudichum does not, however, give any estimate of the amount, composition, and value of the fæces. With regard to the urine, he considers that the voidings of 2,800,000 persons of a mixed population of both sexes and all ages, may be taken as equivalent to those of 2,000,000 adult males. If, therefore, we take the mean of the estimates of Dr. Thudichum and Messrs. Hofmann and Witt with regard to the urine, and those of Messrs. Hofmann and Witt with regard to the fæces, of an adult male, and reduce both in the proportion of from 2·8 to 2 according to Dr. Thudichum's basis of calculation, we shall, provided the estimates of the two authorities be correct, arrive at amounts approximately applicable to an average individual of a mixed population of both sexes and all ages. The following results are so obtained:—

Average of both sexes and all ages, per head per annum.

	Ammonia.	Value.
	lbs.	*s.* *d.*
Urine - - -	11·32	7 3
Fæces - -	1·64	1 2¼
Total -	12·96	8 5¼

Here then, founded upon the estimates of these authorities, we have nearly 13 lbs. of ammonia and nearly 8*s.* 6*d.* of value, *to represent* the annual mixed voidings of an average individual of a mixed population of both sexes and all ages. *In our last Report* 10 lbs. of ammonia only (and the value would

be less in a corresponding degree) were taken to represent the mixed excrements of an average individual. This was the estimate of Messrs. Lawes and Gilbert, founded on very comprehensive data, relating both to the amounts of constituents consumed in the food, and voided in the urine and fæces, of persons of different ages and both sexes. But as this estimate was made nearly 10 years ago, since which time much more evidence has been published relating to the amount and composition of human excremental matters, it has been thought desirable to collate, for the purposes of this Report, as far as possible the whole of the information at command up to the present time bearing upon these points.* The result of very much labour expended in this way indicates 12·6 lbs. of ammonia as the amount annually yielded by each average individual, when the calculation is based upon determinations or estimates of the amounts of nitrogen or ammonia-yielding matters voided by persons of different sexes and ages. But when the estimate is founded upon the recorded amounts of fresh urine and fæces voided by individuals of the different classes, and upon the average composition of urine and fæces respectively, the amount of ammonia indicated as the average per head, per annum, is 12·7.

It is admitted, however, by authorities on the subject, that the experimental data relating to males other than in the prime of life, and especially to females of all ages, are as yet inadequate for the basis of really trustworthy average estimates. Indeed, a careful consideration of the circumstances of the majority of the cases contributing to the averages among those divisions of the population in relation to which the evidence is the most plentiful, and of the relative character of the results where it is the most deficient, leads to the conclusion that the estimate of 12·6 lbs. of ammonia per head per annum, arrived at as above described, is in all probability too high.

Then, again, even assuming the approximate correctness of the estimates of Messrs. Hofmann and Witt and Dr. Thudichum of the amount of ammonia yielded by the urine of an average adult male (and those of Dr. Thudichum are based upon a considerable portion of the same data as the estimate of 12·6 given above), it is difficult to suppose that the urine of two such adults should be equalled by so small a proportion as 2·8 persons of a mixed population of both sexes and all ages; and hence we think that the estimate of nearly 13 lbs. of ammonia as deduced from their joint data regarding adult males, and Dr. Thudichum's measure of reduction, also involves elements of error on the side of excess.

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* For nearly the whole, if not the whole, of the data upon which the new estimates are based, *see* "On the Sewage of London," by J. B. Lawes, F.R.S., Journal of the Society of Arts, March 9, 1855; "The Composition of the Urine in Health and Disease," by E. A. Parkes, M.D., 1860; "On an improved Mode of collecting Excrementitious Matter, with a view to its Application to the Benefit of Agriculture, &c.," by J. L. W. Thudichum, M.D., F.C.S., Journal of the Society of Arts, May 15. 1863; and "On the Elimination of Urea and Urinary Water, in relation to the Period of the Day, Season, Exertion, Food, &c. &c.," by Edward Smith, M.D., LL.B., F.R.S., Philosophical Transactions, Vol. CLI., p. 747.

Lastly, the estimate of Messrs. Lawes and Gilbert of the amount of nitrogen in the food of an average individual, which was founded upon the calculation of 86 different dietaries arranged in 15 classes, according to sex, age, activity of mode of life, and other circumstances, showed an amount equivalent to rather less than 12·2 lbs. of ammonia, from which, of course, a deduction has to be made for the nitrogen retained in the body, and for loss in various ways.

Upon the whole, therefore, it is concluded that the amount of ammonia contributed to the sewer-water by each individual of a mixed population of both sexes and all ages, is pretty certainly more than 10 lbs. per annum as formerly assumed, but probably less than 12 lbs.

But it is not the human excretal matters of the resident population that alone contribute to the value of the sewage of the Metropolitan area. To these must be added those contributed by the population daily visiting the Metropolis from beyond its own limits (less the amount from those daily leaving it), the fractional part of the excretal matters of horses, cows, dogs, and other animals, of the refuse from slaughter-houses, of soot, and of the matters derived from the abrasion of the streets, which does not reach the land as stable dung, street sweepings, or in some other form, and also the refuse matters from certain manufacturing processes. It is very difficult to estimate the amount and value of the constituents reaching the sewers from these sources. They are doubtless large in the aggregate; but a little reflection leads to the conclusion that they are very small per head of the population, and that they must bear a very small proportion to those of the human excretal matters of the resident population. Indeed, so far as existing information bears upon the point, it would appear probable that not more than 12½ lbs. of ammonia are contributed annually to the sewers from all sources, per head, of the population. This, including the associated matters, would, according to trade prices, represent a value of 8*s.* 4*d.* per annum for the manurial constituents of the sewage for each average individual of the population.

The question arises—through how much water are these 12½ lbs. of ammonia (with the associated constituents), or, reckoned in value, through how much is this 8*s.* 4*d.* or 100 pence worth of manurial matter on the average distributed?

The dry weather sewage, or sewage without rainfall, of the Metropolis is variously estimated at from 5 to 7 cubic feet per head per day, equal respectively 31⅙ and 43½ gallons per head per day, or 50¾ and 71 tons per head per annum. According to the imformation furnished by the Referees to Messrs. Hofmann and Witt, it averaged about half way between these two extremes, namely, about 36½ gallons per head per day, equal about 59 tons per head per annum. We shall therefore probably be not far wrong if we take 60 tons per head per annum as the average amount of the normal or dry weather sewage. It is further variously estimated that by subsoil water and rainfall the bulk

of the fluid will be increased by from two thirds to an equal volume.* Adopting the lower of these suppositions, which if too low will allow something for the occasional escape of storm-water, we have the 100 pence worth of constituents distributed through 100 tons of fluid, giving to it a value of one penny per ton according to the estimated market value of its manurial constituents.

What the real average dilution of the sewage the year round is, or will be, will doubtless be more certainly ascertained before long, when the main drainage system is completed, and the works have been a sufficient time in operation to render the gaugings safely available for the purposes of average estimates. In the meantime the following Table will be useful, showing the grains of ammonia per gallon, and the estimated value of the constituents per ton of sewage, on the assumption that the amount of ammonia contributed to the sewage from all sources will be at the rate of 12½ lbs. per head per annum of the population, and on the alternative assumptions, that the amount of fluid will be 60, 70, 80, 90, and 100 tons per head per annum. For comparison with these estimates there are given those of Messrs. Hofmann and Witt, according to their direct analysis of the dry weather sewage, and also the calculated amounts according to their analysis, supposing a dilution of 100 tons per head per annum with subsoil water and rainfall, instead of 60 tons without them, which their mixed sample of the Savoy Street sewer was supposed to represent.

TABLE XI.—Grains of Ammonia per Gallon, and estimated Value of the constituents in one ton, of Sewage at different dilutions, supposing 12½ lbs. of ammonia per head per annum, from all sources.

——	Ammonia per Gallon.	Estimated Value per Ton.
	Grains.	d.
If 60 tons of fluid per head per annum - - -	6·51	1·67
70 ,, ,, ,, - - -	5·58	1·43
80 ,, ,, ,, - - -	4·88	1·25
90 ,, ,, ,, - ..	4·34	1·11
100 ,, ,, ,, - - -	3·91	1·00
Hofmann and Witt—mixed sample of dry weather sewage from Savoy Street sewer - - -	8·21	2·11
The same if diluted with two-thirds its volume of subsoil water and rain-fall - - - -	4·93	1·27

Thus, assuming the amount of ammonia contributed to the sewage from all sources to be 12½ lbs. per head of the population, per annum, the dry weather sewage reckoned at 60 tons per head per annum would contain 6½ grains of ammonia per gallon; and, according to the currently adopted modes of computation, taking dry and portable manures as the standard, the total manurial

* Mr. Bazalgette informs us that the quantities of subsoil water and rainfall are too variable and irregular to enable him to give us any average.

constituents in one ton of such sewage will be worth $1\frac{2}{3}$ penny. Or, reckoning the average sewage, including subsoil water and rainfall, at 100 tons per head per annum, it will contain scarcely 4 grains of ammonia per gallon, and the manurial constituents in one ton of it will be worth just one penny.

If the above estimates for the dry weather sewage be correct, it is obvious that the sample analysed by Messrs. Hofmann and Witt was about one fourth stronger than the average Metropolitan sewage without rainfall. Their sample was, indeed, collected in a manner which gives it a better claim to the character of an average sample than any other of which the circumstances of collection, and the composition as determined by analysis, have hitherto been recorded. Still, it cannot be surprising to find that their results are probably in error to the extent above stated, when it is borne in mind that their sample was taken during 24 hours only, from one sewer only, and from one contributed to by a much more dense population than the average of equal areas in the Metropolitan district.

The approximate correctness of the above estimates of the average composition of the Metropolitan sewage, founded upon a consideration of the amount of manurial matters contributing to it and the amount of water through which they are distributed, is confirmed in a very striking and satisfactory manner by the fact, that the average amount of ammonia in the Rugby sewage, as deduced from the results of the direct analysis of 93 samples, representing the flow of 31 months, is almost exactly that arrived at by calculation, based upon a knowledge of the amount of population, and the average amount of water contributing to the sewage, and upon the assumption that $12\frac{1}{2}$ lbs. of ammonia will be contributed to it per head per annum. Thus, based upon the actual water supply over the three years 1859, 1860 and 1861, and upon the average rainfall over the seven years from 1855–1861 inclusive, it is estimated that there is at Rugby an average of about 60 tons of sewage per head per annum; and as Table XI. shows, if $12\frac{1}{2}$ lbs. of ammonia be distributed through that amount of fluid it will contain $6\frac{1}{2}$ grains of ammonia per gallon, and will have a value, calculated according to the trade prices of its manurial constituents, of $1\frac{2}{3}$ penny per ton. But the 31 months, to the sewage of which the analyses refer, were drier than usual, and hence the average amount of ammonia per gallon amounted to 7 grains, which, still reckoning $12\frac{1}{2}$ lbs. of ammonia per head per annum, is equivalent to only $55\frac{3}{4}$ tons of fluid per head per annum, which is probably more nearly the amount than 60 tons for the comparatively dry period.

Assuming the sewage of Rugby to amount to 60 tons, and that of the Metropolis to 100 tons per head per annum, including subsoil water and rainfall, it results that the latter will have less than two thirds the strength and value of the former. In fact, whilst 1,000 tons of the average sewage of Rugby would represent between 16 and 17 individuals of a mixed population of both sexes and all ages, the same quantity of that of

the Metropolis would represent only about 10 such individuals; and whilst, reckoned according to the amount of constituents they respectively contain, a ton of the average Rugby sewage would be worth $1\frac{2}{3}$ penny, a ton of the Metropolitan sewage would be worth only 1 penny.

It may safely be affirmed that there is, as yet, no record of the analysis of any sample of sewage the circumstances of the collection of which justify the assumption that it fairly represents the average Metropolitan sewage, either with or without subsoil water and rainfall. Compared with any analytical results hitherto published, there can be little doubt that those arrived at by the synthetic method above described are much more trustworthy. It is to be hoped, however, that when the main drainage system comes to be in full operation, competent persons will be appointed to superintend the gauging, sampling, and analysis, with a view to providing data which may serve to determine satisfactorily the approximate average composition of the Metropolitan sewage as it will have to be dealt with in any plan of utilization.

For the convenience of those interested in estimates of the composition and value of town sewage, it may be mentioned that if a value of 8*d.* be put upon every lb. of ammonia, or if for each grain of ammonia per gallon a value of one farthing per ton be given to the sewage, the result will in either case agree almost exactly with that obtained by the elaborate method of giving the currently adopted market values to the several constituents, taking dry and portable manures as the standard.

The subject of the value realized, or realizable, by the agricultural utilisation of sewage in various ways is, of course, quite distinct from that of the estimated money value, according to the trade prices of the constituents, and is considered in other Sections of the Report.

VII. *Composition of the Drainage Water* (*Rugby*).

It is obvious that in attempting to determine experimentally the effects of applying to the land given amounts of sewage of known composition, there are other data essential to a right judgment of the results than those provided in the records of the increased amounts of produce yielded. It is necessary to consider,—

1. To what extent the sewage is deprived of its manurial or putrescible constituents in its passage over and through the land?

2. Whether the sewaged land is left in a higher or a lower condition after the removal of the crop?

To gain some information in reference to the second of these points it was decided that during the season of 1864 the produce of each plot should be carefully weighed, sampled, and analysed, without any further application of sewage, and that the soil of each plot should be submitted to such chemical examination as time and other circumstances would permit. The results of this part

of the inquiry are recorded in Section XII., p. 62, et seq. It may, however, be here observed, in passing, that barley (unmanured) was grown upon the three plots devoted to the experiments on the application of sewage to rye-grass in 1863, and that the crop, during growth, was obviously heavier where sewage had been applied than where it had not, and heavier also where the larger than where the smaller quantity was employed.

In order to determine how far the sewage-water was deprived of its manurial, or putrescible, constituents in its passage over and through the land, samples of the drainage water were collected simultaneously with those of the sewage in each field (commencing May 1862 and ending October 1863), and sent to Professor Way for analysis. In all 62 analyses of drainage water (or rather partial analyses corresponding in detail with those of the sewage) have thus been made. A few other special analyses, in much more detail, have been made of the sewage and drainage of the season of 1864.

The detailed results of the 62 analyses above referred to will be found in Tables XXII.–XXVII., pp. 170–175, in the Appendix. The following Table XV. gives a summary of the results, showing, in parallel columns, the average composition of the sewage and the drainage water, the first division referring to the samples collected during the months of May to October inclusive, 1862, and the second to those obtained from November 1862 to October 1863, both inclusive.

TABLE XV.—Average Composition of the Sewage and Drainage Water collected at Rugby in the Seasons of 1862 and 1863.

Grains per Gallon.

——	Five-acre Field.		Ten-acre Field.		The Two Fields.	
	Sewage water.	Drainage water.	Sewage water.	Drainage water.	Sewage water.	Drainage water.
Season 1862.—May to October, both inclusive.						
Substances in Solution – Organic	7·83	7·18	7·60	7·83	7·71	7·56
Substances in Solution – Inorganic	34·49	34·50	32·38	37·10	33·44	36·01
Substances in Solution – Total	42·32	41·68	39·98	44·93	41·15	43·57
Substances in Suspension – Organic	14·69	1·40	17·14	1·39	15·92	1·39
Substances in Suspension – Inorganic	25·67	1·81	24·89	3·74	25·28	2·92
Substances in Suspension – Total	40·36	3·21	42·03	5·13	41·20	4·31
Total organic matter	22·52	8·58	24·74	9·22	23·63	8·95
Total inorganic matter	60·16	36·31	57·27	40·84	58·72	38·93
Total solid matter	82·68	44·89	82·01	50·06	82·35	47·88
Ammonia – In solution	4·13	0·80	4·26	1·85	4·20	1·41
Ammonia – In suspension	1·37	0·24	1·52	0·33	1·44	0·29
Ammonia – *Total*	5·50	1·04	5·78	2·18	5·64	1·70

		Five-acre Field.		Ten-acre Field.		The Two Fields.	
—		Sewage water.	Drainage water.	Sewage water.	Drainage water.	Sewage water.	Drainage water.
Season 1863.—November 1862 to October 1863, both inclusive.							
Substances in solution	Organic	8·35	7·46	8·30	7·98	8·32	7·73
	Inorganic	39·57	38·55	38·77	41·35	39·18	39·98
	Total	47·92	46·01	47·07	49·33	47·50	47·71
Substances in suspension	Organic	27·35	1·41	25·99	3·29	26·69	2·37
	Inorganic	39·41	2·14	34·93	3·93	37·22	3·06
	Total	66·76	3·55	60·92	7·22	63·91	5·43
Total organic matter		35·70	8·87	34·29	11·27	35·01	10·10
Total inorganic matter		78·98	40·69	73·70	45·28	76·40	43·04
Total solid matter		114·68	49·56	107·99	56·55	111·41	53·14
Ammonia	In solution	5·88	0·69	5·69	1·85	5·76	1·28
	In suspension	2·03	0·15	1·98	0·31	2·03	0·23
	Total	7·91	0·84	7·67	2·16	7·79	1·51

It is seen that of the matter in suspension nearly the whole, both organic and inorganic, has been separated from the sewage in its passage over and through the land; the drainage water containing but little of either, and probably a considerable part of that which it did contain was not contributed by the sewage, but was derived from the soil itself.

Of matter in solution, on the other hand, a gallon of drainage water contained sometimes more and sometimes less, but on the average much about the same amount both organic and inorganic as a gallon of the sewage. Here, again, there can be little doubt that a considerable portion of the matters found in the drainage water had their source in the soil itself—that there had, in fact, been an interchange; the sewage giving up to the soil valuable manurial constituents, and the fluid in its turn taking up substances from the soil for which the latter had less power of retention.

The character of the interchange of matters in solution as the sewage passed through the soil will be better understood on an inspection of Table XVI. (overleaf); but before referring to its details attention should be directed to one or two other points brought to light in Table XV.

As might be expected there was a larger portion of almost every constituent, or class of the constituents, enumerated, in the drainage from the high ridged and steeply sloping 10-acre field, over and through which the fluid passed the more rapidly, than in that from the almost level 5-acre field. This result is not only the most remarkable in degree, but the most important to remark, in the case of the ammonia. Thus, whilst a gallon of the drainage water from the 5-acre *field contained*, in 1862 only from one fifth to one *sixth, and in 1863 little* more than one tenth as much ammonia

as a gallon of the sewage, a gallon of the drainage from the 10-acre field contained, in 1862 more than one third, and in 1863 more than one fourth as much as an equal volume of the sewage. It is obvious, therefore, that the retention by the soil of the valuable manurial matters of the sewage was much less perfect in the case of the high ridged and steeply sloping 10-acre than in that of the flatter 5-acre field.

As above referred to, Table XVI., which now follows, shows more in detail the changes in the composition of the fluid in its passage through the soil.

TABLE XVI.—Detailed Composition of Samples of Sewage and Drainage Water collected at Rugby in the Summer of 1864.

Constituents.		Grains per Gallon.			
		Collected July 6–11.		Collected July 13–18.	
		Sewage.	Drainage.	Sewage.	Drainage.
In solution	Inorganic matter :—				
	Oxide of Iron, &c.	Traces.	—	1·25	0·25
	Lime	8·45	10·25	8·23	10·08
	Magnesia	1·76	1·69	1·80	1·69
	Soda (1)	5·46	0·38	5·24	2·30
	Chloride of Sodium (1)	6·82	9·73	8·53	9·21
	Chloride of Potassium (1)	6·08	1·50	6·17	2·34
	Sulphuric acid	4·39	6·55	4·01	6·75
	Phosphoric acid	1·28	0·44	1·66	0·32
	Carbonic acid	8·83	6·18	7·42	7·01
	Silica	1·80	0·80	1·00	0·80
	Total	44·87	37·52	45·31	40·75
	Organic matter	11·20	7·80	10·00	7·05
	Total matter in solution	56·07	45·32	55·31	47·80
In suspension	Inorganic matter :—				
	Oxide of Iron and Alumina	4·57	..	6·30	..
	Lime	4·48	..	3·75	..
	Magnesia	0·65	..	0·25	..
	Carbonic acid	3·25	..	2·17	..
	Phosphoric acid	1·84	..	1·14	..
	Silica, sand, &c.	31·60	..	39·30	..
	Total	46·39	..	52·91	..
	Organic matter	40·40	..	32·40	..
	Total matter in suspension	86·79	..	85·31	..
	Total inorganic matter	91·26	37·52	98·22	40·75
	Total organic matter (2)	51·60	7·80	42·40	7·05
	Total solid matter	142·86	45·32	140·62	47·80
(1) Containing	Potass	3·84	0·94	3·90	1·48
	Soda	9·07	5·54	9·76	7·17
	Chlorine	7·03	6·61	8·10	6·70
(2) Containing	Ammonia: In solution	5·74	0·98	6·36	0·92
	Ammonia: In suspension	2·92	..	2·42	..
	Ammonia: Total	8·66	0·98	8·78	0·92
	Nitric acid in solution = Ammonia	..	(3) 1·33	..	(4) 1·41

(3) 4·227 Nitric acid = 1·096 Nitrogen = 1·331 Ammonia.
(4) 4·483 " " = 1·162 " = 1·411 "

The samples of sewage and drainage to which Table XVI. refers were not collected in either of the fields formerly under experiment, but in a meadow in the occupation of Mr. Campbell, where sewage had been pretty liberally applied for the last two or three seasons, but in which the application had been suspended for some weeks until within a few days of commencing to take the samples. The plan of collection, both for sewage and drainage, was, to take of the former about a gallon, and of the latter about half a gallon, 8 or 10 times during the 10 or 12 working hours of the day; at the end of the day after well shaking to take a gallon from each mixture, and to repeat this for six consecutive days until six gallons of each was obtained; when, from each, after well shaking, a two gallon sample was taken, and sent to Professor Way for analysis. The sewage flowed from the main into open runs for distribution over the land, but for the purpose of collecting the samples, the stand pipe was each time affixed, and the water allowed to flow through it for ten minutes before the sample was taken. The drainage was taken direct from the main cross pipe drain at the lower end of the field. Both sewage and drainage were allowed to run an hour or two each morning before taking the first sample.

During, and for sometime previous to, the collection of these samples, the weather was unusally dry, and the land was itself so dry, and in many places cracked, that it was feared a good deal of the sewage would find its way too directly to the drains. Judging from the results, however, which show a less amount of matter in solution (both organic and inorganic) in a gallon of drainage in proportion to that in an equal volume of sewage than in the average of the cases relating to the other fields and previous seasons, it would appear that the soil had done its work of absorption at any rate as well in the cases to which the more detailed analysis refer as in the majority of the others. It would, obviously, be desirable to have samples taken for analysis under very different conditions of the weather and of the land; and the plan was, to have such samples taken and analysed; but up to the time of writing the drought has continued, and it is doubtful whether results relating to wetter weather can be available for embodiment in the present report.

In judging of the results of either Table XV. or XVI., it will of course be borne in mind, that the quantity of any constituent in a gallon of the drainage water compared with that in a gallon of the sewage, by no means directly indicates the proportion supplied by the latter which has not been taken up by the soil. We had not the means of gauging the amount of fluid passing off as drainage water; but excepting when the land is already saturated, it must obviously be considerably less than that passed on to it as sewage. In fact, a gallon of drainage water will represent much more than a gallon of sewage, and hence the amount of any consituent of the sewage found in a gallon of the drainage must have been derived from more than a gallon of the former. The non-retention of valuable manurial matters by the soil was, therefore,

not so great as would at first sight appear from an inspection of the comparative composition of equal volumes of sewage and of drainage water.

It is satisfactory to observe that, of the inorganic matters in solution in the sewage, by far the larger proportion of those constituents which, by the removal of the produce from the land, are the most likely to become deficient relatively to others, is retained by the soil. Thus, smaller proportions of both the potass and the phosphoric acid coming on to the land in the sewage passed off in the drainage than of any other constituents. Of the bases, soda was also retained by the soil to a considerable extent, magnesia in a less degree, and lime less still. Indeed, of lime, there was more in a gallon of drainage than in a gallon of sewage. Of sulphuric acid, again, there was considerably more in the drainage than in an equal volume of the sewage. Lastly, of soluble silica a considerable portion passed off in the drainage.

Of inorganic matter in suspension, the quantity in the drainage water was so small, and it was so obviously derived from the soil, that it was considered quite unnecessary to submit it to analysis. It may be concluded, indeed, that practically the whole of the suspended matter of the sewage, both inorganic and organic, would be retained by the soil. It will be observed that a considerable proportion of the phosphoric acid of the sewage was in the suspended matter; and as there was none in that of the drainage, a much larger proportion of the total amount of that constituent of the sewage was retained by the soil than appears from the figures relating to the phosphoric acid in solution alone.

Of organic matter in solution a very considerable quantity was found in the drainage water; though, compared with the amount in the sewage, not quite so much in the two cases to which Table XVI. refers as on the average of the large number of cases to which Table XV. relates. There can be little doubt, however, that the soluble organic matter of the drainage was very different in character to that in the sewage. That set down as soluble organic matter in the sewage contained a very much larger proportion of nitrogen as ammonia, or ammonia-yielding matter, than that in the drainage. It is probable too, that, during periods of active vegetation, a notable portion of the soluble organic matter of drainage will frequently be derived from vegetable matter within the soil, and not directly from the sewage.

An important point to remark, which the more detailed analyses recorded in Table XVI. discloses, is, that whilst the sewage did not contain an appreciable amount of nitric acid, the drainage contained more nitrogen in that form than as ammonia; and adding the amount of ammonia to which the nitrogen in the nitric acid is equivalent to that determined as such, it would appear that the soil had not retained so large a proportion of that important manurial constituent of the sewage as might have been judged if only the more partial analyses, the average results of which are recorded in Table XV., had been made.

The amounts of potass, phosphoric acid, ammonia, and nitric acid, found in the drainage water, clearly show that the sewage was not perfectly deprived of its valuable manurial matters in its passage through the soil; and the amounts of total soluble matter, and especially of soluble organic matter, show that it was by no means perfectly purified. There is, indeed, a limit, depending upon the physical and chemical characters of the soil, and upon the amount and composition of the fluid passed through it, to the power which a soil possesses of removing substances from solution, or of preventing those already absorbed from being dissolved, in water passing through it; and so far as the soluble organic matters of the drainage are derived from vegetable matter within the soil, it is a question whether there will not always be a considerable amount in that passing from land covered with a luxuriant vegetation. So far, however, as the nitrogen of the drainage exists in the form of nitric acid, it is a pretty satisfactory indication that the organic matter has to a great extent already passed the stage of deleterious putrescence.

In the experiments under consideration the arrangements were not such as to allow of the water drained from one portion of the land being passed over another, otherwise it would no doubt have been more completely both utilized and purified. At Beddington, near Croydon, where a tract of about 250 acres is already laid down for sewage irrigation by gravitation and open runs (and the area is in course of enlargement), a great portion of the water does duty twice, and sometimes three times; and from the results of some analyses of the sewage and of the drainage water, which have kindly been communicated by Mr. Latham, the Engineer to the Croydon Local Board of Health, it appears (see Appendix, No. 3, p. 203.) that the water eventually passes from the land in a state of much greater purity than was the case in the Rugby experiments. In fact, before the present arrangements were in force, the Croydon Board had to meet numerous law suits on account of the pollution of the river by the sewage; but so efficiently is the sewage now purified that those having the right of fishing in the river have found it worth while to fix gratings to prevent the fish going up the main outfall from the sewage irrigated land.

It is clear that in any extensive scheme for the irrigation of grass land by sewage, the arrangements should be such as to allow of the water being passed over or through the land more than once, so that both the utilisation and the purification may be as complete as possible.

VIII. *Composition of the Unsewaged and Sewaged Grass.*

It has been seen that, reckoned in the fresh or green state, a greater weight of sewaged than unsewaged grass, was required to yield a given amount of milk or increase in live

weight; but that less of the dry or solid substance of tl sewaged than of the unsewaged grass was required to produ a given amount of milk or increase. It was further found tha especially in the case of the sewaged grass, it required less, bo of green grass and of dry substance of grass, to yield a give return in milk during the earlier than the later portions of tl season, and also less in one season than in another. It obviously important, therefore, to ascertain the difference in tl proportion of dry or solid substance, and the difference in tl composition of the solid substance itself, of the grass grow without and with sewage, with smaller and with larger quantiti of sewage, at different periods of the season, and in differe seasons.

The mode of taking and preparing samples for analysis w sufficiently described in our former Report; and the gener results of the analyses of the produce of the first season (186 were also there discussed; the details being given in Tabl XXXIX., XLV., in the Appendix to that Report.

The detailed results of the analysis of the produce of 18(and 1863 are given in Tables XXVIII.–XL., pp. 176–193, Appendix No. 1. to the present Report; but the following sur mary Tables XVII. and XVIII. bring together, side by side, tl mean results, both as to proportion of dry substance and compo tion of dry substance, for each of the three seasons over whi the experiments have been conducted, and these will be sufficie to indicate the chief points of interest.

The general indications of the further results now adduced a strictly accordant with those formerly reported; the only ne point illustrated being the difference in the composition of tl grass in one season compared with another.

Comparing first the composition of the grass produced und different conditions, in one and the same season, it is seen th there is in each season a very great difference, both in the pr portion of the dry substance and in the composition of that d substance, according to the varying circumstances of growt With scarcely an exception in either season, the proportion dry or solid substance in the grass as cut, weighed, and give to the animals, was considerably lower in the sewaged than the unsewaged grass, and generally the lower the larger tl quantity of sewage employed. There was also, pretty uniforml a diminished proportion of dry substance in each successive cutti as the season advanced.

It will be readily understood that the proportion of dry solid substance in the grass depends upon the stage of growt the proportion of leaf and stem, and the condition of the weath at the time of cutting. The grass grown without sewage was f the most part cut at a later stage of growth, and showed mo tendency to form stem and seed than that grown with it, a *the greater the* quantity of sewage the greater was the producti

Table XVII.—Per-centages of Dry Substance in the Unsewaged and the Sewaged Grass.

Seasons 1861, 1862, and 1863.

	Five-acre Field.					Ten-acre Field.				
	Un-sewaged,	Sewaged.			Mean.	Un-sewaged,	Sewaged.			Mean.
	Plot 1.	Plot 2.	Plot 3.	Plot 4.		Plot 1.	Plot 2.	Plot 3.	Plot 4.	
Meadow Grass. First Season, 1861.										
1st Crop	27·9	30·5	26·9	27·7	28·3	22·0	23·3	21·4	18·4	21·3
2d Crop	24·4	19·8	14·2	13·3	17·9	26·9	17·1	15·1	16·1	18·8
3d Crop	..	13·4	13·7	12·9	13·3	..	12·6	7·3	14·4	11·4
4th Crop	..	..	15·4	9·6	12·5	..	16·9	15·1	17·8	16·6
Mean	26·2	21·2	17·6	15·9	..	24·5	17·5	14·7	16·7	..
Meadow Grass. Second Season, 1862.										
1st Crop	26·7	22·8	14·4	15·3	19·8	26·9	19·5	13·5	13·1	18·3
2d Crop	22·8	14·3	16·4	19·4	18·2	17·9	16·2	19·0	16·7	17·5
3d Crop	..	18·2	12·9	14·2	15·1	..	14·5	14·4	15·8	14·9
4th Crop	..	..	..	..	..	..	..	..	*33·8	33·8
Mean	24·8	18·4	14·6	16·3	..	22·4	16·4	15·6	15·2	..
Meadow Grass. Third Season, 1863.										
1st Crop	36·1	21·5	17·6	16·3	22·9	30·8	18·6	20·0	14·6	23·3
2d Crop	34·4	18·5	14·9	17·8	21·4	18·2	17·7	16·3	18·3	17·8
3d Crop	..	17·7	10·9	17·6	15·4	..	12·4	14·6	15·2	14·1
4th Crop	..	15·8	13·0	12·3	13·7	..	..	13·9	13·6	13·8
5th Crop	..	..	..	15·3	15·3	..	..	..	..	..
Mean	35·3	18·4	14·1	15·9	..	29·0	16·2	16·2	15·6	..

Italian Rye Grass, 1863.

	Un-sewaged,	Sewaged.		Mean.
	Plot 1.	Plot 2.	Plot 3.	
1st Crop	21·3*			21·3
2d Crop	23·7	18·8	17·5	20·0
3d Crop	36·4	27·5	18·3	27·4
4th Crop	33·2	13·8	18·9	22·0
5th Crop	19·9	16·8	17·8	18·2
6th Crop	..	18·6	20·4	19·5
	28·3	19·1	18·6	..

* All three plots were unsewaged until after the first cutting.

Table XVIII.—Mean Composition (per cent.) of the Dry Substance of t[illegible] Grass, without and with Sewage, and in each successive Crop.

In Seasons 1861, 1862, and 1863.

	Without and with Sewage.				Each successive Crop.					
	Un-sewaged,	Sewaged.								
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	1st Crop.	2d Crop.	[illegible] Crop.	4th Crop.	5th Crop.	6[illegible] Cr[illegible]
Meadow Grass—First Season, 1861.										
Number of analyses giving the means	5	7	9	9	11	9	7	5		
Nitrogenous substance (N × 6·3)	13·08	18·67	18·92	19·78	10·38	18·07	23·76	28·23		
Fatty matter (ether extract)	3·21	3·54	3·53	3·44	3·01	3·60	3·65	3·64		
Woody fibre	28·80	29·34	30·15	30·13	30·80	28·45	28·50	28·60		
Other non-nitrogenous substances	45·66	37·09	35·94	35·92	47·79	38·28	30·84	24·57		
Mineral matter (ash)	9·25	11·36	11·46	11·78	8·07	11·60	13·25	14·74		
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00		
Meadow Grass—Second Season, 1862.										
Number of analyses giving the means	4	6	6	7	11	9	6	1		
Nitrogenous substance (N × 6·3)	9·49	13·65	15·70	16·83	11·65	13·70	20·44	18·23		
Fatty matter (ether extract)	2·93	3·31	3·64	3·85	2·68	3·72	4·34	4·42		
Woody fibre	29·30	29·20	29·18	29·86	32·42	29·01	26·69	24·85		
Other non-nitrogenous substances	47·34	40·70	40·50	39·01	44·40	43·87	36·00	38·70		
Mineral matter (ash)	9·94	10·64	10·98	10·45	8·71	10·70	12·53	13·80		
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00		
Meadow Grass—Third Season, 1863.										
Number of analyses giving the means	4	7	8	9	8	8	6	5	1	
Nitrogenous substance (N × 6·3)	10·31	18·43	20·49	21·38	15·05	16·64	19·38	26·12	33·19	
Fatty matter (ether extract)	4·06	5·04	4·08	4·63	4·79	4·31	5·00	4·93	5·07	
Woody fibre	28·64	26·08	25·62	25·40	26·55	28·07	26·09	23·33	20·51	
Other non-nitrogenous substances	47·29	39·48	37·82	35·79	44·32	39·68	37·05	33·26	29·62	
Mineral matter (ash)	9·68	10·97	11·89	11·80	9·29	11·30	11·29	12·36	12·61	
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	
Italian Rye-grass, 1863.										
Number of analyses giving the means	8	5	5		1	3	3	3	3	
Nitrogenous substance (N × 6·3)	12·44	18·76	18·11		12·51	12·36	11·07	16·70	20·91	24
Fatty matter (ether extract)	3·63	4·46	3·85		3·61	3·01	3·29	4·31	4·49	5
Woody fibre	24·68	25·51	25·58		17·79	26·95	28·79	27·16	28·64	22
Other non-nitrogenous substances	49·21	39·76	41·47		56·59	48·28	48·88	40·87	33·34	33
Mineral matter (ash)	10·14	11·50	11·09		9·50	8·90	7·98	10·96	12·62	14
	100·00	100·00	100·00		100·00	100·00	100·00	100·00	100·00	100

of succulent leaf; though, even with sewage, the tendency to run to seed is much greater in hot and dry than in cold and wet seasons. Then again, the earlier crops of the season are not only grown under much more favourable maturing conditions, but, from their much greater abundance, they are generally cleared more slowly, and are therefore liable to be in a more advanced stage when cut; whilst the later ones are not only produced under less favourable maturing circumstances, but are frequently much more affected in their condition by unfavourable weather at the time of cutting.

With Italian rye grass, as well as with meadow grass, the herbage in the condition in which it was cut was found to be much more succulent when grown with sewage than without it. In the case of the rye grass, however (though it is true only small quantities of sewage were applied, and the results relate to only one season), the diminution in the proportion of dry substance as the season advanced was somewhat less marked.

The general result is, that there was a less proportion of dry or solid substance in the sewaged grass, as cut, than in the unsewaged; but that a given amount of dry substance in the sewaged was more productive of milk and increase than an equal amount in the unsewaged grass.

The question arises,—was there any difference in the composition of the dry or solid substance of the unsewaged and the sewaged grass which may account for the higher food-qualities of that of the sewaged?

Table XVIII. shows that the most remarkable difference was in the proportion of the nitrogenous constituents, the per-centage of which was in each season much higher in the solid matter of the sewaged than in that of the unsewaged grass, and also the higher the greater the quantity of sewage applied. The proportion of green and impure fatty or waxy matter was also somewhat, but in a less degree than the nitrogenous substance, the greater in the sewaged grass. The comparatively indigestible woody fibre, judging from the results of 1862 and 1863, when the sewaged crops were cut in a younger and more favourable condition than in 1861, will probably average less in sewaged than in unsewaged grass. But the mineral matter, like the nitrogenous and green fatty or waxy matters, is in the larger amount in the sewaged grass, and like them also, a relatively large amount of it is generally indicative of a more unripe and succulent condition.

That the higher milk-yielding qualities of the solid matter of the sewaged grass do not depend simply on its higher per-centage of nitrogenous constituents is evident from the fact that the solid matter of the later crops of the season, which, weight for weight, had much less value as food than that of the earlier, nevertheless contained a very much higher proportion of nitrogenous substance. Indeed, there was generally more than twice as much nitrogenous

substance in a given amount of the solid matter of the last than of the first crop of the season.

It would appear that the higher qualities of the solid matter of the sewaged grass, and of the grass grown in the earlier and more genial periods of the season, were due rather to a favourable condition of maturation, and, therefore, of digestibility and assimilability, of the constituents. That the condition of maturation or elaboration of the constituents had much to do with the quality of the grass is evident from the fact that the produce of the warmer seasons of 1861 and 1863 was much more productive than that of the cold and wet season of 1862. And that a comparatively high per-centage of nitrogenous substance is only advantageous when accompanied with a favourable condition of maturation, may be gathered from the fact that with the higher per-centage of nitrogen in the produce grown in the more favourable seasons of 1861 and 1863 there was higher feeding quality, whilst with the higher per-centage of nitrogen in the produce grown in the later and colder periods of the seasons, there was lower feeding quality.

Italian rye grass seems to be subject to very similar variations in composition, by the application of sewage, and at different periods of the season, as meadow grass; but as the amounts of sewage applied to it were comparatively small, and the results relate to one season only, it can scarcely be judged with certainty, whether or not the changes in composition would, under compararable circumstances, be much the same in degree as well as kind, with the two descriptions of herbage. The feeding results seem to indicate that the Italian rye grass deteriorated somewhat less than the meadow grass as the season advanced, but the difference in chemical composition offers no very obvious explanation of the fact.

IX. *Effects of Sewage on the mixed herbage of grass land in developing the more freely growing, at the expense of the less freely growing plants.*

It is well known that active manures of any kind, when applied to the mixed herbage of grass land, develop certain more freely-growing plants to the partial, or in some cases, the entire exclusion of others. Irrigation, whether by sewage or otherwise, produces very similar effects.

On careful inquiry, and by the aid of samples obtained from some of the most important sewage meadows in the neighbourhood of Edinburgh, it is found that wherever the application has been continued for a considerable number of years, the produce consists almost exclusively of rough meadow grass (*poa trivialis*), common couch grass (*triticum repens*), and in a smaller proportion of rye grass (*lolium perenne*), or rough cock's-foot (*dactylis glomerata*), *or both;* the chief weed being crow-foot (*ranunculus*), of various

species. In four out of five reports from as many different sewage farmers, the poa is said to stand first, and the couch grass second in degree of prominence. The poa also seems to stand first in estimation as a sewage grass; whilst the common couch is also much valued. Indeed, Mr. Thomson, of Roseburn, informs us that he has actually transplanted this weed of our corn fields from his arable land to lay down for sewage meadow, and that the result has been quite satisfactory; he also informs us that when he has sown as many as 15 or 20 different kinds, most of them have gradually died out, and after some years only a few suitable to the land and the treatment remained. (See notes on the Edinburgh Meadows, Appendix, p. 198 et seq.)

At Rugby similar effects, but at present in a less degree, have been produced. The following observations on the character of the herbage in the two fields are founded upon the records of a careful examination made in August 1862, since which time, however, further change has doubtless taken place on the sewaged plots.

The portion of land left unsewaged by the Commission in the five-acre field had received less sewage previously than that in the ten-aere field, and showed somewhat greater complexity of herbage.

In the five-acre field the most prominent grasses on the unsewaged portion were woolly soft-grass (*holcus lanatus*), common bent grass (*agrostis vulgaris*), rough meadow grass (*poa trivialis*), hard fescue (*festuca duriuscula*), rough cock's-foot (*dactylis glomerata*), and rye grass (*lolium perenne*), with a number of others in much smaller proportion. The herbage also comprised several species of the Leguminous family, besides a number of weeds, of which the most prominent were ribwort (*plantago lanceolata*), milfoil (*achillæa millefolium*), sorrel dock (*rumex acetosa*), and dandelion (*taraxacum dens-leonis*). In the ten-acre, as in the five-acre field, the cock's-foot, woolly soft grass, rye grass, and hard fescue, were among the most prominent of the grasses without sewage, whilst the rough meadow grass, and others, were less prominent than in the five-acre field. The amount of Leguminous herbage was also less than in the five-acre field, whilst crow-foot was extremely abundant.

In the sewaged herbage of both fields the cock's-foot and woolly soft grass were by far the most abundant, the rye grass coming next, and perhaps the rough meadow grass or the hard fescue next, others being more reduced. In both fields the Leguminous herbage was much reduced in proportion under the influence of sewage, whilst in the five-acre field the sorrel-dock, and in the ten-acre the crow-foot, were the most prominent weeds.

In the sewage meadows near Croydon, the cock's-foot and rye grass appear to be the predominating grasses.

The general effect of sewage irrigation on the mixed herbage of meadow land may be stated to be, to develop the Graminaceous

herbage chiefly, nearly to exclude the Leguminous, and to reduce the prevalence of miscellaneous or weedy plants, but much to encourage individual species. It also, at the expense of the rest, encourages a few free-growing grasses, among which, according to locality and other circumstances, the rough meadow grass, couch grass, rough cock's-foot, woolly soft grass, and rye grass, have been observed to be very prominent. The result is an almost exclusively Graminaceous, and very simple herbage. But, as the produce of sewage irrigated meadows is generally either cut or grazed in a very young and succulent condition, the tendency which the great luxuriance of a few very free-growing grasses has to give a coarse and stemmy later growth is not an objection, as it is in the case of meadows left for hay. Indeed, as has been already shown, when the produce is given to animals in a green and succulent state, a given weight of the dry or solid substance of the more simple sewaged grass is more productive than an equal weight of that of the more complex unsewaged produce.

X. *Composition of the milk yielded from the unsewaged and from the sewaged grass.*

Once a week during the greater part of the season of 1861, the morning and evening milk of the cows fed on unsewaged grass was mixed together, and a gallon sample taken. Samples of the milk from the sewaged grass were taken in the same way. In 1862 similar samples were collected, but then only once a month. In 1863 none were taken. In all cases the samples were, as soon as taken, put into bottles filled up to the corks, sealed down, and sent off the same evening by railway to Professor Way for analysis.

In 1861 there were in all 13 samples of milk from unsewaged, and 15 from the sewaged grass, and in 1862, six from the unsewaged and six from the sewaged grass so collected and submitted to analysis. The results of each of the 28 analyses of the milk of 1861 were given in Table XLVI. in the Appendix to the previous Report, and those of the 12 made of the milk of 1862 are given in Table XLI., p. 194, in the Appendix to the present Report.

In the following summary Table, XIX., the results of the whole 40 analyses of milk are so classified as to bring to view the chief points of interest.

TABLE XIX.—Mean per-centage Composition of the Milk produced from Unsewaged and Sewaged Grass, alone or with Oilcake in addition, and in different Seasons.

SEASONS 1861 and 1862.

—	SEASON 1861.					SEASON 1862.	
	Cows fed on						
	Grass alone.		Grass and Oilcake.		Sewaged Rye-grass and Clover, and Oilcake.	Grass and Oilcake.	
	Un-sewaged.	Sewaged.	Un-sewaged.	Sewaged.		Un-sewaged.	Sewaged.
Number of Analyses giving the Means	9.	10.	4.	4.	1.	6.	6.
Casein	3·246	3·241	3·352	3·423	3·125	3·513	3·467
Butter	3·604	3·430	3·657	3·707	3·473	3·834	3·559
Sugar of Milk, &c.	4·405	4·218	4·561	4·690	4·700	4·502	4·440
Mineral matter	0·753	0·776	0·740	0·771	0·752	0·753	0·771
Total solid matter	12·008	11·665	12·310	12·590	12·050	12·602	12·237
Water	87·992	88·335	87·690	87·410	87·950	87·398	87·763
	100·000	100·000	100·000	100·000	100·000	100·000	100·000

The average results of the numerous analyses of the milk of the season of 1861 showed a somewhat lower proportion of each of the constituents—casein, butter, sugar, &c.—and also of total solid substance, but a slightly higher proportion of mineral or saline matter in that from the sewaged than in that from the unsewaged grass, when, for a period of 16 weeks, the cows were fed on grass alone. But when, for a period of four weeks at the end of the season, oilcake was given in addition to the grass, the milk from the sewaged grass contained rather more instead of less of casein, butter, sugar, &c., and total solid matter, than that from the unsewaged; and both kinds of grass, although at the end of the season, gave, with oilcake in addition, milk containing more of each of the constituents mentioned than the grass of the earlier and more genial periods of the season when it was given alone.

In 1862 the season was very cold and wet, and the yield of milk, with cake given in addition to the grass throughout the season, was little if any better than during the period of the more favourable season of 1861, when the cows had grass alone. But both from unsewaged and from sewaged grass the milk of 1862, when oilcake was given, was somewhat richer than that of 1861 without it; and as during the longer period of 1861 when grass was given alone, so now in 1862 when cake was given throughout, the milk from the sewaged grass contained less solid matter, and was in fact somewhat less rich, than that from the unsewaged. This result of an entire season is, of course, more reliable than that obtained with *oilcake* during the concluding four weeks only of *the season of 1861,* which showed as above observed a rather

richer milk from oilcake and sewaged than from oilcake and unsewaged grass. Upon the whole it would appear probable that, under otherwise comparable conditions, unsewaged grass will give a slightly richer milk than sewaged, whether given alone or with other food in addition.

The general result is, that a given weight of fresh unsewaged grass, supplying as it did much more solid matter, gave more milk than an equal weight of the fresh sewaged grass; that a given amount of the dry or solid substance of the more succulent sewaged grass gave considerably more milk than an equal quantity of that of the unsewaged; that the addition of oilcake, whether to unsewaged or to sewaged grass, increased the richness of the milk; but that the milk from the sewaged grass (whether given alone or with oilcake) was somewhat less rich than that from the unsewaged.

XI. *Experiments on the application of Sewage to Oats in* 1863.

For reasons that have been already explained, the Commission did not think it desirable to undertake a systematic series of experiments with any other crops than grass. Indeed, so to have extended their inquiry, would have required much more ample funds than were at their disposal for experiments on the agricultural utilisation of sewage. By the kindness of Mr. J. A. Campbell, however, they are enabled to record the results of an experiment on the application of sewage to oats.

In the spring of 1863, in a field from which a crop of clover had been carried off in 1861, and in 1862 a crop of wheat, Mr. Campbell was about to give the then growing crop of oats a top dressing of nitrate of soda. Instead of this, four plots of about an acre each, were set apart and treated as follows:—

Plot 1. Left unmanured.
Plot 2. Sewaged at the rate of 135½ tons per acre.
Plot 3. Sewaged at the rate of 510 tons per acre.
Plot 4. Top-dressed with 1½ cwt. of nitrate of soda.

The applications of the sewage, and of the nitrate, were made much later in the season than was desirable. The sewage was applied from April 28 to May 16 inclusive; the two acres requiring, with the hindrance of gauging by means of a barrel, 16 days for the application by hose and jet of the small quantities stated. The nitrate of soda was sown broadcast, partly on April 24, and partly on May 4.

For several weeks from the time of sowing there was very little rain, so that the plant top-dressed with nitrate of soda was obviously injured by the application for some time, the foliage being much "burnt." The sewage, on the other hand, being applied during dry weather, and the application followed by a very unusally dry period, during which spring corn and even wheat crops were reputed over a considerable range of country to be suffering for want of rain, produced, as might be expected, very marked effects. Owing, too, to the small amount of rain,

the sewage was of more than the average concentration of that of Rugby, and probably about double the average strength of that of the Metropolis (including rain, &c.) The following Table (XX.) shows the results obtained.

TABLE XX.—Results of Experiments on the application of Sewage to Oats.

Rugby 1863.

Plots.	Manures.	Quantities per Acre. Dressed Corn.	Offal Corn.	Straw.	Increase by Manure. Corn.	Increase by Manure. Straw.	Particulars of Quality. Weight per Bushel of dressed Corn.	Offal Corn to 100 dressed.	Total Corn to 100 Straw.
		Bush. Pks.	Lbs.	Cwts.	Lbs.	Cwts.	Lbs.		
1	Unmanured - -	55 2¼	85	42½	..	..	44	3·5	53·3
2	135½ tons sewage -	69 1¾	212	53	658	10¾	43	7·1	53·9
3	510 tons sewage - -	66 2¼	302	61	565	18¾	42	10·8	45·4
4	1¾ cwt. Nitrate of Soda	54 0¾	131	45¾	—11	3	44	5·5	49·6

Thus, under the conditions of season described, there was with the nitrate of soda even rather less corn, and only about 3 cwts. more straw, than without manure, and the smaller quantity of sewage gave more increase of corn than the larger, though the latter gave considerably the most straw. Both the sewaged crops were, indeed, too luxuriant to bear up against the heavy rains of June, and the one with the largest amount of sewage was very much laid, and hence the deficient yield of corn in proportion to straw. The last three columns show, by the deficient weight per bushel of the dressed corn, the large proportion of offal corn, and the low proportion of corn to straw, where the largest quantity of sewage was employed, that the defective result as to corn in its case was due to over rather than to under luxuriance. In fact, the usual complaint when sewage has been applied to growing corn crops has been of over production of straw and deficient proportion of corn—that is to say, of a tendency of growth which is as unfavourable in the case of corn as it is favourable in that of grass.

There was, however, a very high gross money return per ton of sewage applied, at any rate where the smaller quantity only was employed. Thus, reckoning oats at 3*s*. per bushel, and oat straw at 20*s*. per load, the gross value of the increased produce from one ton of sewage was—

With 135½ tons of sewage per acre - 5¼*d*. per ton.
With 510 tons of sewage per acre - 1½*d*. per ton.

Here, then, with a small quantity of sewage of nearly double the average strength of that of the Metropolis, applied during a period of very dry weather, which was followed by a season of very unusual productiveness—the harvest of 1863 being the best for many years past—the gross value of the increased produce amounted to more than 5*d*. per ton of sewage employed, or to

nearly three times the market value of the constituents of th
sewage supposing them to have been extracted and dried.

The smaller amount of sewage applied was equivalent in wate to something under an additional 1½ inch of rain at the critica period of growth; and the larger amount was equal to about fiv inches, which would at that period have been a very great excess and of itself caused rank and over luxuriant growth on any soi in such condition as the unmanured produce showed the one i question to have been. It is indeed difficult to say how much c actual result obtained was due to the manurial constituents, an how much to the water of the sewage. At any rate, whethe considered with regard to the amount of manurial constituent supplied, or the amount of water, an average of 500 tons c sewage per acre to arable land otherwise treated in the ordinar way would most probably be found more than appropriate to th average of soils and seasons, and would most certainly be mor than appropiate for heavy lands and for wet seasons; nor even i dry ones, when sewage would be worth a maximum value fo some crops by virtue of its water, if applied at the proper time would more than this amount be required the year round; thoug it is possible that the demand might be as much beyond the suppl for a short period, as the supply would undoubtedly be beyon the demand for very much the greater part of the year so far a arable land was concerned.

XII. *Miscellaneous Results obtained in* 1864.

It has been already stated (Section VII. p. 45) that in order t ascertain whether the meadow land experimented on in 1861 1862, and 1863 were left in a higher or in a lower condition b the application of sewage, and the removal of the produce durin those three years, it was decided that the produce of each plo should, in 1864, be carefully weighed, sampled, and analysed without any further application of sewage; and also that the soi of the respective plots should be so far submitted to chemica examination as time and other circumstances would allow. Th results of this part of the inquiry will form the subject of th present Section.

Owing to the extraordinary drought of the season of 1864, i was, as will be readily understood, as unfavourable as it possibl could be for meadow land without either sewage or other manur Indeed, from only one plot was any second cutting taken, an then only a few cwts. of green grass were obtained. In all othe cases the after-grass came forward so late in the season that i was thought better to feed it off than to cut it.

The following Table (XXI.) shows the amounts of green gras obtained from each plot; and some particulars of the feeding o the remainder of the produce will be given further on.

Table XXI.—Produce of Green Grass obtained per Acre in 1864, without Sewage.

Plots.	Treatment in 1861, 1862, and 1863.	Five-acre Field. Dates of Cutting.	Five-acre Field. Quantity.				Ten-acre Field. Dates of Cutting.	Ten-acre Field. Quantity.				Mean of the Two Fields.			
			tons.	*cwts.*	*qrs.*	*lbs.*		*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*
	First Crop.														
1	Unsewaged - -	June 18—20	1	14	3	26	June 16 and 17	3	1	2	0	2	8	0	27
2	3,000 tons sewage per acre, per ann.	June 4—9	2	17	2	20	June 8—13	5	12	1	15	4	5	0	3½
3	6,000 tons sewage per acre, per ann.	May 24—30	5	12	0	18	June 1—7	7	4	0	9	6	8	0	13½
4	9,000 tons sewage per acre, per ann.	May 19—23,	5	9	0	17	May 26—June 1	6	11	0	11	6	0	0	14
	Second Crop.														
4	9,000 tons sewage per acre, per ann.	Aug. 24	0	4	3	3	..	-	-	-	-	-	-	-	-

Small as were the amounts of produce on all the plots, it is nevertheless clear that there was much more growth where sewage had been applied in the preceding years than where it had not; and there was more where 6,000 than where 3,000 tons had been applied, even though the crop was in the former case cut some days earlier at the most active period of growth; and from the indications there would doubtless have been more still where 9,000 tons had been annually applied, but for the still earlier dates of cutting.

The evidence so far is, then, that the land was left in the higher condition of productiveness the larger the quantities of sewage applied, and of produce removed, in previous seasons; and although a second cutting was taken in only one instance, and when feeding off the after-grass the plots were not separated so as to afford exact evidence on the point, it may be stated that in both fields the amount of feed was obviously much the greater the greater the quantity of sewage previously applied. Indeed, it is concluded that in each field the plot 4 gave as much after-feed as plots 2 and 3 together.

In the ten-acre field the after-grass of the 4½ to 5 experimental acres kept 8 heifers, of about 7½ cwts. live-weight each, for 11 days, from Nov. 11 to Nov. 22; 104 sheep of about 160 lbs. average live-weight for 14 days, from Nov. 10 (morning) to Nov. 23 (evening); and 102 of the same sheep for 7 days from Dec. 7 to Dec. 14. The five-acre field, where the growth was not so good, kept 32 lambs, averaging about 90 lbs. live-weight, for 35 days from Nov. 18 to Dec. 23.

Further evidence of the effects of the unexhausted residue from the previous sewage manuring is to be found in the difference in the chemical composition of the produce from the respective plots. This point is illustrated by the results of analyses given in the following Table. For further details, see Appendix, Table XLII. p. 195.

TABLE XXII.—Composition of the Grass obtained in 1864, without Sewage.

—	First Crop.								2d Crop
	Five-acre Field.				Ten-acre Field.				Five-acre Field.
	Unsewaged.	Sewaged in 1861-2-3.			Unsewaged.	Sewaged in 1861-2-3.			
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot
Per-cent. in the Fresh Grass.									
Dry Substance	34·70	30·19	28·12	20·33	33·36	30·84	23·63	21·50	55·
Per-cent. in the Dry Substance of the Grass.									
Nitrogenous substance (N × 6·3)	10·09	13·73	14·91	16·07	11·00	12·95	15·63	13·47	15·
Fatty matter (ether extract)	3·87	3·66	3·75	4·43	3·88	4·14	5·03	4·85	5·
Woody fibre	26·64	26·64	27·61	28·21	27·36	27·12	28·21	26·94	29·
Other non-nitrogenous substances	51·65	48·39	45·33	42·20	50·95	48·17	42·52	46·12	41
Mineral matter (ash)	7·75	7·58	8·40	9·09	6·81	7·62	8·61	8·62	7
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	190

The first point to remark is, that as the proportion of dry or solid substance was much lower in the earlier cut and less matured sewaged grass than in the later cut unsewaged grass, the difference in the relative amount of the produce per acre on the respective plots was in reality not so great at the actual dates of cutting as the amounts of fresh or green grass recorded in the Table would indicate. The lower per-centages of dry substance in the sewaged grass indicate indeed a less degree of maturity or ripeness at the time of cutting; and with these characters a higher per-centage of nitrogenous substance in the solid matter of the grass would be expected. But the differences in the per-centage of nitrogenous substance which the Table shows are greater than can be accounted for by the earlier or later cutting, and consequent less or greater degree of ripeness.

The solid matter of the unsewaged produce of the one field contained 10, and of the other 11 per cent. of nitrogenous substance; whilst in that of the produce from the previously sewaged plots it ranged from about 13 to about 16 per cent., and was, with one exception, the higher the greater the quantity of sewage previously applied.

It has been shown in Section VIII. that the proportion of nitrogenous substance in the solid matter of the grass was much increased under the influence of sewage, and the results here recorded, taken together with those relating to the amounts of *produce per* acre, clearly show a considerable effect from the *unexhausted residue* from the previous sewage manuring, even in so *extremely* unfavourable a season; and it would doubtless have

been much greater under more favourable circumstances, and will probably be manifest for some time to come.

Although the amount and the composition of the grass obtained in 1864 have clearly shown the effect of the previous sewage manuring, the only partial investigation to which the soils have been submitted does not further illustrate the point. Calculation would, indeed, seem to indicate that there had been considerable accumulation, at a greater or less depth within the soil, of some of the most important manurial constituents of sewage where the larger quantities had been applied, but it was not thought desirable to incur either the necessary delay or the increased expenditure which a sufficiently detailed investigation of the subject would involve.

The results obtained are, however, of considerable interest as showing a very great difference in the character and composition of the soils of the two fields, which to a great extent explains the marked difference in the amount of produce which they respectively yielded without sewage.

Appendix Table XLIII. p. 196, shows the great difference in the general character, and Table XLIV. p. 197, in the chemical composition in some important respects, between the two soils.

It will be recollected that the unsewaged portion of the ten-acre field each year yielded much more produce than that of the five-acre field. The former was known to have a heavier soil, and a more sunny aspect; but these differences were not recognised as fully accounting for the great difference in the natural productiveness. The results of the partial mechanical and chemical analysis show, however, that, within a layer of 9 inches, taken immediately below as thin a sod as could be first removed, the lighter, gravelly, and naturally less productive soil of the five-acre field contained an average of nearly 20 per cent. of stones, whilst similar layers from the ten-acre field did not on the average contain half as much. Again, the separated fine mould from the soil of the five-acre field was sandy, contained about 15 per cent. of moisture, between 5 and 6 per cent. of organic matter, and scarcely one fifth per cent. of nitrogen, whilst that of the more productive ten-acre field was loamy, containing a good deal of clay, about one fourth more moisture, more than one half more organic matter, and about one third more ammonia, or nitrogen in some other form. Or, comparing the composition of the total fresh soils, including stones, instead of that of the separated fine moulds, the differences are in a still greater degree in favour of the soil of the ten-acre field, so far as the indications of natural fertility are concerned.

It is, however, very satisfactory to know, that the soil of the much less naturally fertile five-acre field gave fully as much produce per acre under the influence of liberal dressings of sewage, as that of the naturally much more productive ten-acre field. This result is quite confirmatory of the general opinion, founded on the results of practical experience, that light, and even naturally poor and unproductive soils, are capable of yielding very large crops of grass under the influence of sewage, and that they are, in fact, the best *suited for* its application.

XIII. *Concluding Observations; general Considerations on the Agricultural Utilisation of Town Sewage.*

There cannot be a doubt that to obtain a maximum amount an gross value of produce from a given amount of sewage it should b applied in small quantities per acre, and in dry weather. But i is clear that the maximum value per ton of sewage which woul be obtainable under such conditions would be available only fo short periods of the year; and, it is equally certain, that th constant daily supply, the year round, would, at all other times have to be disposed of at a very different rate, thus reducing th average value very considerably. It is obvious, indeed, that eve supposing sewage were distributed over a sufficiently large are to command its full value, both as manure and as water, at th best periods of the year, the much larger remainder must eithe be sacrificed, or at the best used for grass at periods when it value even for that crop must be very much reduced.

Even assuming that during any considerable portions of eac year the Metropolitan sewage would be worth to the farmer 2*d* per ton distributed over his arable land, there can still be n doubt that the average value the year round would be reduced t considerably below 1*d*. by the use of the remainder in large quan tities to grass at the less favourable periods of the season.

Adopting the favourable supposition that as high an average a 500 tons of sewage per acre could be utilised on arable land, an that as low an average as 5,000 tons per acre were found sufficien for Italian rye and meadow grass, the important practical ques tions arise—would the increased productiveness, and increase gross money return per ton, in the former case, justify the extr cost of distribution over a ten-fold area, and to a great extent b pipes and hose and jet instead of by open runs?—or, havin regard, not to the greatest amount of produce and of gross mone return, but to the greatest profit, per ton of sewage, would it no be far more remunerative to limit the area, and cost of distributio at a certain sacrifice of the productiveness of the sewage?

The probability is, however, that the difference of area require under the two systems would be greater than that here assume for the purpose of illustration; and then, of course, the differenc in the cost of distribution of a given amount of sewage would b still further increased. In fact, to utilise the constituents of th Metropolitan sewage over an area at all corresponding to the rat per acre of the smaller and more productive application to oats a Rugby, it would require more nearly a twenty-fold than a ten-fol area as compared with that of such an application to grass land a above supposed.

The great dilution of the Metropolitan sewage, indeed of tow sewage generally, its large daily supply at all seasons, and it greater amount in wet weather when the land can least bear, o least requires, more water, render it extremely inappropriate fo application on a comprehensive scale to arable land for the growt of corn and other ordinary rotation crops. But, apart from thes difficulties, if it can only be distributed in small quantities ove large areas at such a cost to the farmer as has as yet been pr

posed, it is indeed vain to hope that any large proportion of the manurial constituents derived from the consumption of human food in our towns, can be distributed over the area from which they came.

A modified proposition is, to make arrangements for delivering the sewage over a large area, and to all crops, so as to obtain a high price per ton for so much as can be applied under the most favourable conditions of the land, the crop, and the season, having in reserve a sufficient tract of grass land to purify and utilise the surplus not so available. But this surplus would be very large, and the largest at those periods of the year when of the least value even for grass land, so that the gross value per ton of sewage the year round would be very much reduced.

Having regard to the cost of distribution, it is probable that a much more profitable mode of utilisation would be, to limit the area by specially adapting the arrangements for the application of at any rate the greater part, if not the whole, to permanent or other grasses, laid down to take it the year round, trusting to the occasional use to other crops within easy reach of the area so commanded, but relying mainly on the periodically broken up rye-grass land, and on the application to arable land of the solid manure resulting from the consumption of the sewaged grass, for obtaining other produce than milk and meat by means of sewage.

The question arises—how much land would be requisite for the purification and utilisation of the sewage of a given population on such a plan?

Putting out of view, for the moment, the sanitary consideration of the sufficient purification of the sewage, and the economical one of the manurial value of its constituents, and looking merely to obtaining the largest possible amount of green produce from a given area of land, there is scarcely any limit to the amount of sewage that might be employed, even up to 40,000 or 50,000 tons per acre per annum. But, so far as existing experience furnishes data for a judgment on the point, it may be concluded that the use of about 5,000 tons per acre, judiciously applied to grass land properly laid down to receive it, would, in a great majority of cases, secure the most profitable utilisation. Where, however, the drainage from the sewaged land must be turned into a river, other considerations than those relating only to the most profitable utilisation at once arise. Such an application as is here supposed would doubtless ensure a sufficient purification of the water to admit of its being turned into rivers without fear of detriment to fish; whilst, any streams receiving such drainage instead of that direct from the towns would, at any rate, be vastly improved from their previous condition as a water supply for other towns; but, whether or not, when this most important point has to be taken into consideration, the purification would be sufficient with an application of as much as 5,000 tons per acre per annum, is a question which requires the aid of further experience, and

further investigation, to answer satisfactorily, and which may, indeed, receive a different answer in different cases.

Assuming that the excretal matters of each individual of the Metropolitan area are, or will be, on the average, diluted with 100 tons of water per annum, including water supply, rainfall, and subsoil water, 5,000 tons of sewage would be contributed by fifty individuals in a year, and at this rate, a population of 3,000,000 would require, for the purification and utilisation of its sewage, an area of about 60,000 acres annually under irrigation. So far as Italian rye grass were grown, it might be estimated that the land devoted to it would one year in three be broken up, and some other crop be grown upon it, and to a corresponding extent the area laid down for irrigation would require to be extended beyond the 60,000 acres supposed. Then again, it is obvious that the manure produced by the consumption of the sewaged grass must either be re-distributed by means of water, in which case the area under actual irrigation would be again increased, or, if collected and used in the solid form, it would be appropriate for application to arable land, and so to the growth of corn and other products; and it is obvious that for the most profitable utilisation in this way of the manure derived from the consumption of the sewaged grass, such arable land would require to be either within the area laid down for irrigation, or so near its limits as to reduce the cost of carriage as far as possible.

The experiment with oats above referred to, and that with wheat made by the Chairman of the Commission, the Earl of Essex, the results of which his lordship gave in his evidence before the Sewage Committee of 1862, are the only cases in which exact quantitative results have been recorded of the effects of sewage applied to corn crops.

In the case of the experiment of the Earl of Essex, nothing is known of the strength of the sewage, and nothing is recorded of the characters of the season.

In the case of those with oats at Rugby, as already observed, the sewage was stronger than the average of that of Rugby, and much stronger than the average of that of the Metropolis, the weather was unusually dry at the time of the application, and the season was upon the whole one of very extraordinary productiveness, and, under these conditions, a very high gross return was obtained for a given amount of sewage. Judging from the results of the Earl of Essex, it is probable that the circumstances, both as to the strength of the sewage and character of the season, were in his case also unusally favourable.

At any rate, these isolated results, the one obtained under conditions known to be far above an average character, and the other under entirely unknown conditions, are obviously quite inappropriate as the basis for general conclusions as to the probable average results obtainable on the application of sewage to arable land for corn and other rotation crops.

It is, indeed, desirable that systematic trials should be made with different corn and other rotation crops, through several consecutive seasons, and that the results should be accurately recorded for the guidance of the public.

Although there is still wanting evidence of an exact and quantitative kind upon which to found estimates of the probable average results obtainable over various seasons, on the application of given quantities of sewage, of known strength, to corn and other rotation crops, yet evidence of common experience as to the applicability, in a practical or economical point of view, of sewage to such crops, is by no means wanting. The most extensive and systematic trials have been made at Rugby, Watford, and Alnwick.

At Rugby, the sewage from a population of between 6,000 and 7,000 individuals is collected in a receiving tank, from which it is pumped by a 12-horse power engine through iron pipes which are laid down for the distribution over 470 acres of mixed grass and arable land. These arrangements have been in existence for about 11 years. About 190 acres of the land so piped have, from the commencement, been held by J. A. Campbell, Esquire. But he has gradually limited the area of application, until, during the last few years, he has abandoned the use of the hose and jet, excepting occasionally on a small scale, and confined the application almost exclusively to from 12 to 20 acres of meadow and Italian rye grass. The greater part of the remainder of the 470 acres was, for some time previous to 1861, held by Mr. Berry Congreve, who, after trying sewage on arable as well as grass land, was glad to give up his holding, after having sustained considerable loss. The present tenant of the sewage works, and of the land formerly held by Mr. Congreve, is Mr. Bicknell Mullins, who entered into the occupation in 1861, and although he had between 250 and 300 acres laid down for the application of sewage to crops generally, and by hose and jet, he in practice confines it to about 100 acres of grass land, and applies it almost entirely by open runs.*

The result at Rugby is, then, that after about eleven years of practical experience, with arrangements adapted for the application of sewage to arable land, and to all crops, its use to any other crops than meadow and Italian rye grass forms no part of the general system adopted, and is, in fact, entirely exceptional.

In the neighbourhood of Watford, the Earl of Essex laid down pipes for the application of the sewage of the town by hose and jet to about 210 acres of mixed arable and grass land. The result which his lordship obtained on the application of only 134 tons of sewage to an acre of wheat has frequently been held to be conclusive proof of its applicability in small quantities, over large areas, and to all crops. But, in the evidence given by his lordship before the Sewage Committee of 1862, he stated, very

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* Since the above was in type Mr. Mullins has informed us that during the dry season of 1864 he applied sewage to about four acres of roots, and apporently with good results.

emphatically, that his great error had been the piping of too much land; that the sewage of Watford, derived from a population of about 4,000, was not sufficient for more than about 60 or 70 acres; that he required 5,000 tons per acre for 10 acres of rye-grass; and that applying the remainder to 35 acres of meadow, he really had none to spare for wheat. It should be added, that, since the date of this evidence, the area of application has been still further contracted.

In other words, the result at Watford is, that although the abandonment of one acre of rye-grass would set free sewage enough for nearly 40 acres of wheat, if only applied at the rate which yielded the large profit which has been so frequently quoted, yet his lordship's practical experience has led him to prefer the application to the one acre of rye-grass, rather than to the nearly 40 acres of wheat.

In the neighbourhood of Alnwick, the Duke of Northumberland, some years ago, put down machinery and piping for the distribution of the sewage of from 6,000 to 7,000 individuals, over about 270 acres of mixed arable and grass land. It was applied in small quantities to various rotation crops, and in larger quantities to grass; but after a very short time the tenants who had the free use of the sewage for the cost of its application, entirely abandoned it; and the Bailiff of the district, who reports the failure, expresses his opinion strongly against the applicability of sewage to arable land. The failure at Alnwick has been attributed by those connected with the undertaking, to the great dilution of the sewage; and the analyses recorded of it would indicate a composition even much below that of the probable average of the Metropolitan sewage. But Mr. Rawlinson, who directed the sewerage arrangements at Alnwick, states, that not only are water-closets universal, but that the supply of water from all sources is certainly very much lower per head of the population contributing to the sewage there than in the case of the Metropolis; and it is obvious that, if this be the case, the average sewage must be in a corresponding degree the stronger.

At Edinburgh sewage has been applied to some portions of grass land for about 200 years, to a considerable portion for more than 60, and to most of the land now under irrigation, amounting to about 395 acres, for more than 30 years. It is there that larger amounts of sewage are applied per acre than anywhere else, and it is there that larger amounts of produce are obtained per acre than anywhere else. There is, however, no doubt, that at Edinburgh there is not only great waste of manurial constituents, but very imperfect purification of the sewage. The distribution is entirely by means of open runs. In two instances arrangements have been made for raising the sewage, by pumping, an inconsiderable number of feet; but it has been found that the cost has been too great to allow a sufficient quantity to be *applied per acre*, and hence the application in this way has been *much limited, if not* on some portions of the land entirely aban-

doned. The application to ordinary rotation crops, on arable land, forms no part of the system adopted at Edinburgh.*

Next to Edinburgh, the attempt to utilize sewage on a large scale which has been the most succesful so far as the amount of produce obtained per acre is concerned, is that of Mr. Marriage in the neighbourhood of Croydon, where about 250 acres of meadow and Italian rye grass annually receive an amount of sewage which averages rather more than 6,000 tons, and represents the excretal matters of between 60 and 70 persons per acre per annum. As, however, the fluid is always passed over several portions of land in succession, by which means a considerable portion is used on an average about $2\frac{1}{2}$ times over, it results that each acre receives annually $6{,}000 \times 2\cdot5 = 1{,}5000$ tons of fluid—*less* the amount which evaporates or passes off below the drains which collect and carry it off from one portion to be utilised on another. An enlargement of the area is, indeed, contemplated, which, notwithstanding the rapid increase of the population of the neighbourhood, will, if carried out as proposed, somewhat reduce the amount of fluid and of excretal matters available per acre below the quantities above stated. Mr. Marriage has not yet applied sewage in any systematic manner to arable land; but he was intending to try its effects upon root-crops during the past season (1864).†

In attempting to estimate by the aid of the evidence afforded by these various trials on a large scale, carried out by practical men with a view to profit, the value to the farmer of a ton of town sewage, we may, on account of the conditions above stated, exclude the Edinburgh results from our consideration.

At Croydon, again, the undertaking is of too recent establishment, the results have been obtained over too few seasons, and the present contract was made, on either side, under such disadvantages or uncertainty, that the experience there does not provide the adequate data for such an estimate. It may be observed, however, that after deducting £4 rental from the estimated gross value of the produce per acre at present prices, the gross return is, so far as can be calculated, with Italian rye grass from $\frac{3}{4}d.$ to $1d.$, and with meadow grass from $\frac{1}{2}d.$ to $\frac{3}{4}d.$ for each ton of sewage employed. But there can be little doubt, that if the supply of such produce were very greatly increased, the present market price would not be maintained.

At Rugby, where for about eleven years arrangements have been made for the distribution of small quantities of sewage over a large area, and to all crops, and where the sewage is much stronger than that of the Metropolis, the cost to the tenants averages about $\frac{3}{4}d.$ per ton delivered at the hydrants in the fields. Yet, both the present tenants have been glad, rather than incur the loss of using the sewage themselves at that cost, to get rid of it for the purposes of these experiments, at rates which,

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* For further particulars relating to the Edinburgh sewage meadows, see Appendix No. 2. p. 198, et seq.

† For further *details relating to* Croydon, see Appendix No. 3. p. 202, et seq.

though three times as high during the six summer as during the six winter months, have averaged the year round scarcely, but very nearly, 1$d.$ per ton at the hydrants.

Lastly on this point, in his evidence before the Sewage Committee of 1862, the Earl of Essex stated, as the result of his experience, which it will be remembered included the very favourable result with wheat, that in his opinion sewage would not be profitable to the farmer unless he could have it at from ½$d.$ to ¾$d.$ per ton.

The experiments at Rugby to which this Report refers, having been conducted on feeding meadow land of more than average quality, the produce without sewage was doubtless considerably more than would be obtained from the average of such land as is likely to be devoted to the growth of grass by means of sewage on the large scale. For this reason, and also on account of the less perfect purification and utilisation of the sewage than would be attained where a large tract were so laid down as to allow of the passage of the fluid from one plot over a second, and so on, until it were properly exhausted, the amounts, and value, of the increase estimated according to the actual results of the experiments as due to the application of given quantities of sewage, are probably below those which would be attainable under good management in actual practice on the large scale.

Reviewing the whole of the results, both of the experiments and of the experience of common practice on the subject hitherto, with due regard to the circumstances under which they were obtained, and having regard also to both urban and rural interests, it is considered that an application of about 5,000 tons of sewage per acre per annum, to meadow or Italian rye grass, will, in a great majority of cases, prove to be the most profitable mode of utilisation. It is at the same time considered pretty certain that the farmer would not pay ¾$d.$, and even very doubtful whether he could afford to pay ½$d.$ per ton, the year round, for sewage of the average strength of that of the Metropolis (excluding storm water) delivered on his land.

SUMMARY.

The results of the whole inquiry may be briefly enumerated as follows:—

1. As there is a daily supply of sewage the year round, which, on sanitary and engineering grounds, it is essential to dispose of as soon as it is produced, and as passing it over land is the best mode both of purifying and utilising it, it should be employed for purposes of irrigation, and be applied in winter, when of comparatively little value, as well as in summer, when of more.

Results obtained on the Application of Sewage to Meadow and Italian Rye Grass.

2. By the application of sewage to grass land during the winter months a very early cut or bite of green food may be obtained, but the amount of increased produce due to the winter application is comparatively small for the amount of sewage employed.

3. By means of sewage irrigation the period during which an abundance of green food was available was extended considerably at the end as well as at the beginning of the season, and the more so the larger the quantity of sewage applied, almost up to the highest amount employed—namely, 9,000 tons per acre.

4. One of the experimental fields gave much less produce per acre without sewage than the other, and analysis showed its soil to be much less naturally fertile; but it gave fully as much produce per acre under the influence of liberal dressings of sewage as the naturally much more fertile soil.

5. Taking the average over three years, and in the two fields, the amount of produce obtained without sewage was about 9¼ tons, of green grass per acre per annum, equal about 3 tons of hay; and with 3,000, 6,000, and 9,000 tons of sewage per acre per annum the amounts were, respectively, about 22¼, 30¼, and 32½ tons of green grass—equal respectively (reckoned according to the percentage of dry substance in each) about 5, 5¾, and 6½ tons of hay.

6. The largest quantities of produce per acre were obtained in the third year of the experiments, and with 9,000 tons of sewage per acre per annum; namely, in one field 35 tons, and in the other 37 tons of green grass, equal respectively about 6 tons 12¾ cwts., and 7 tons 1 cwt., of hay.

7. The average increase obtained for each 1,000 tons of sewage was—when 3,000 tons per acre per annum were applied, about 5 tons of green grass; when 6,000 tons were applied, 4 tons 2¼ cwts.; and when 9,000 tons were applied, 3 tons 3¼ cwts. of green grass.

8. The amount of produce per acre was the greater the greater the quantity of sewage applied, up to 9,000 tons per acre; but the amount of increase of produce obtained for a given amount of sewage was the less where the greater amounts were applied.

9. Experiments with rye grass were made in one season only, sewage was not applied until the end of April, and comparatively small quantities were put on. The results so obtained indicated much about the same amount of increase of produce for a given amount of sewage as with meadow grass.

Results obtained with fattening Oxen.

10. When cut and given to fattening oxen tied up under cover, more sewaged than unsewaged grass, reckoned in the fresh or green state, was both consumed by a given weight of animal within a given time, and required to produce a given weight of increase; but of real dry or solid substance, less of that of the sewaged than of the unsewaged grass was required to produce a given effect.

11. When cut grass was given alone the result was very unsatisfactory; but when oilcake was given in addition the amount of increase upon a given weight of animal within a given time, and for a given amount of dry substance of food consumed, was not far short of the *average* result obtained when oxen are fed under *cover on a good mixed* diet.

12. The money return, whether reckoned per acre or for a given amount of sewage, was much less with fattening oxen thai with milking cows.

Results obtained with milking Cows.

13. When cows were fed on unsewaged, or sewaged grass, a much as they chose to eat, a given weight of the animal was mor productive, both of milk and increase, but especially of milk, oi the unsewaged than on the sewaged grass.

14. From a given weight of unsewaged grass, reckoned in thi fresh or green state, more milk was produced than from an equa weight of fresh sewaged grass; but a given weight of the dry o solid substance supplied in sewaged grass was on the averag more productive than an equal weight supplied in unsewage grass.

15. The milk producing quality of the grass was very differen in different seasons, and at different periods of the same season. I was very inferior in the wet and cold season of 1862, and toward the close of the seasons as compared with the earlier periods. I appears probable that Italian rye grass deteriorates less toward the end of a season than meadow grass. On the average, abou six parts by weight of fresh grass yielded one part by weight o milk.

16. By the aid of sewage, the time that an acre would keep a cow, and the amount of milk yielded from the produce of an acre were increased between three and four-fold.

17. So far as the results of the experiments afford the means o judging, it is estimated that with an application of about 5,000 ton of sewage per acre per annum to meadow land, an average gros produce of not less than 1,000 gallons of milk per acre per annun may be expected.

18. In experiments conducted with Italian rye grass (but i one season only), more milk was obtained by the use of a give amount of sewage applied to it than to meadow grass.

19. With an application of about 5,000 tons of sewage per acr per annum, an average gross return of from 30*l.* to 35*l.* per acre in milk at 8*d.* per gallon, may be anticipated.

Composition of the Rugby Sewage.

20. The mean of 93 analyses, of as many samples, of th Rugby sewage, collected over a period of 31 months, shows 6 ; grains of ammonia, and 87½ grains of total solid matter, pe gallon; equal to 207¾ lbs. of ammonia, and 2,803 lbs. of tota solid matter per 1,000 tons. Or, taking the mean of the averag composition fixed by the analyses for each of the 31 months instead of the direct mean of the total 93 analyses, the averag contents would be almost exactly 7 grains of ammonia, an 92½ grains of total solid matter per gallon; equal to 224 lbs. o 2 cwts. of ammonia, and 2,960 lbs., or about 26½ cwts. of tota solid matter, per 1,000 tons.

21. Although each sample analysed was the mixture of portions taken every two or three hours for several days together, the variation in composition at different times was very great; the amount of ammonia varying in the different mixed samples from 2½ to about 15½ grains per gallon, or from 81½ to 500½ lbs. per 1,000 tons, whilst the total solid matter varied from about 37½ to about 270 grains per gallon, or from 1,203 to 8,637 lbs. per 1,000 tons.

22. 1,000 tons of the average sewage of Rugby represent the excretal and other matters of from 17 to 18 average individuals of a mixed population of both sexes and all ages for a year, and contain ammonia equal to that in from 11 to 12 cwts. of Peruvian guano; or, about 1,700 tons of such sewage would contain nitrogen reckoned as ammonia equal to that in 1 ton of Peruvian guano.

23. It is estimated that there are at Rugby, including rainfall, &c., on the average from 55 to 60 tons of sewage per head of the population per annum.

24. Judging from the average composition of the Rugby sewage, and of various crops, it is concluded that potass would be more likely than phosphoric acid to become deficient where town sewage was applied constantly to grass-land, whilst phosphoric acid would be more likely to become deficient than potass if it were applied to the ordinary crops of rotation.

Estimated average Composition of the Metropolitan Sewage.

25. There is as yet no record of the analysis of any samples or sample of sewage collected under circumstances fairly to represent the average Metropolitan sewage either with or without rainfall and subsoil water.

26. It is estimated that the Metropolitan sewage amounts on the average to about 60 tons without, and probably to about 100 tons with, rainfall and subsoil water, per head of the population per annum.

27. It is estimated that, including human excretal and other matters, there are annually contributed to the Metropolitan sewage about 12½ lbs. of ammonia per head of the mixed population of both sexes and all ages.

28. Reckoned according to the currently adopted trade prices of the several constituents, taking dry and portable manures as the standard, the total annual value of the manurial constituents contributed to the sewage, supposing them to be extracted and dried, would amount to 8*s.* 4*d.* per head of the population.

29. Accordingly, in the dry weather sewage of the Metropolis, reckoned at 60 tons per head per annum, there will be about 6½ grains of ammonia per gallon, and the manurial constituents in 1 ton, if extracted and dried, would be worth about 1⅔*d.*; and in the average sewage with rainfall, &c., reckoned at 100 tons per head per annum, there will be scarcely 4 grains of ammonia per gallon, and the total manurial constituents in 1 ton will have an estimated value of 1*d.*

30. 1,000 tons of the average Metropolitan sewage withou rainfall, reckoned at 60 tons per head per annum, represent th excretal and collateral manurial matters from nearly 17 averag individuals, and contain ammonia equal to that in about 11 cwts Peruvian guano; and 1,000 tons with rainfall, reckoned a 100 tons per head per annum, represent the manurial matter from 10 average individuals, and contain ammonia equal to tha in about 6½ cwts. Peruvian guano. In other words, about 1,80 tons of the average Metropolitan sewage without, and about 3,00 tons of the average sewage with rainfall, &c., would contain nitroge reckoned as ammonia equal to that in 1 ton of Peruvian guano.

31. The value of the total manurial constituents in sewage reckoned according to the currently adopted trade prices of th several constituents, taking dry and portable manures as th standard, is pretty exactly indicated by putting a value of 8*d.* o every lb. of ammonia, or by giving a value of one farthing per to for every grain of ammonia per gallon of the sewage. But thi theoretical value, according to composition and the trade prices c the constituents, cannot, of course, be taken as directly indicatin the value realized, or realizable, by the agricultural utilisation i various ways, of sewage of different strengths.

32. It is very desirable that as soon as the Main Drainag system is sufficiently advanced and in practical working, com petent persons should be appointed to undertake the gauging sampling, and analysis, of the Metropolitan sewage, in suc manner as satisfactorily to determine its average composition i the condition in which it will have to be dealt with in any pla of utilisation.

Composition of the Drainage Water (Rugby).

33. Analyses of the drainage water passing from the ex perimentally sewage-irrigated land at Rugby showed that thos constituents which are of the most value, because the mo liable to become relatively exhausted, had been the most efficientl retained by the soil, but that the water still contained a con siderable amount of valuable manurial matters, besides a larg quantity of other substances less important as manure, but affectin the purity of the water.

34. When large quantities of sewage are applied to grass lan the arrangements should be such as to allow of the water bein used more than once, so that both the utilisation and the purif cation may be as complete as possible.

Chemical Composition of the Grass.

35. The sewaged meadow grass, as cut and given to tl animals, contained a less proportion of dry or solid substanc than the unsewaged; and the grass cut during the later portion of the season (both unsewaged and sewaged) contained less soli matter than that cut during the more genial periods of growth.

36. Italian rye grass, in the condition as cut, was also found to be more succulent and to contain less solid matter when grown with sewage than without it; but the proportion of dry substance diminished less as the season advanced in its case than in that of the meadow grass.

37. The proportion of nitrogenous substance (and also of impure waxy or fatty matter) was much greater in the solid matter of the sewaged, than in that of the unsewaged grass. The proportion of nitrogenous substance was also much higher in the solid matter of the grass grown towards the end than earlier in the season. The proportion of indigestible woody fibre was much about the same in the dry substance of the unsewaged and of the sewaged grass. It progressively diminished as the season advanced, and was generally lower in the dry substance of the Italian rye than in that of the meadow grass.

38. A given amount of the dry substance of grass grown in a cold and wet season, or during the cold and wet periods of the year, generally contains more nitrogenous substance, but is less productive than that of grass grown in more genial weather.

39. The greater productiveness in milk and increase of a given amount of the solid matter of the sewaged grass appears to depend more on a favourable condition of maturation, digestibility, and assimilability, of the constituents, than on the actual per-centage amount of any of those determined, and above enumerated.

Effects of Sewage on the mixed Herbage of Grass Land.

40. The effect of sewage irrigation on the mixed herbage of grass land is to develop the Graminaceous plants chiefly, nearly to exclude the Leguminous, and to reduce the prevalence of miscellaneous or weedy plants, but much to encourage individual species.

41. Among the grasses which have been observed to be the most encouraged by sewage are (according to locality or other circumstances) rough meadow grass, couch grass, rough cock's foot, woolly soft grass, and perennial rye grass; two or three only remaining in any considerable proportion after sewage has been liberally applied for some years.

42. The produce of sewage irrigated meadows being generally cut or grazed very young, the tendency which the great luxuriance of a few very free growing grasses has to give a coarse and stemmy later growth is not an objection as in the case of meadows left for hay; a given weight of the dry or solid substance of the more simple sewaged grass being, when consumed green, more productive than an equal weight of that of the more complex unsewaged herbage.

Composition of the Milk from the unsewaged and the sewaged Grass.

43. Although more milk was obtained from a given weight of the dry or solid substance of sewaged than of unsewaged grass, there *was comparatively* little difference in the composition of

richness of the milk from the two kinds of grass. That from the sewaged grass was, however, slightly the less rich, containing somewhat less of casein, butter, sugar, and total solid matter (though more mineral matter) than that from the unsewaged.

44. When oilcake was given with the grass (whether sewaged or unsewaged) the richness of the milk was notably increased.

Results obtained on the Application of Sewage to Oats.

45. In an experiment with oats in which 135½ tons of sewage were applied per acre, the gross value of the increased produce amounted to more than *5d.* per ton of the sewage employed, or to about three times the market value of the constituents of the sewage, supposing them to have been extracted and dried; and in another experiment in which 510 tons were applied per acre, the gross value of the increased produce amounted to about 1¼*d.* per ton of the sewage employed.

46. In the experiment with the smaller quantity of sewage the supply of water was equivalent to something under an additional 1½ inch of rain at the critical period of growth, and in that with the larger amount to about 5 inches, which proved to be a great excess at the period of the season at which it was applied, there being an over production of straw, and the crop being much laid. Both experiments were made in the unusually productive season of 1863, and with sewage of about double the average strength of that of the Metropolis, which was applied during a period of very dry weather. It is obvious, therefore, that the results were quite exceptional, and cannot be taken as indicating what might be expected from the application of small quantities of sewage to corn crops on different soils, and on the average of seasons.

47. It is probable that 500 tons of sewage per acre is more than would be appropriate to arable land otherwise treated in the ordinary way, taking the average of soils and seasons; and it is certainly more than would be appropriate for heavy lands, and for wet seasons.

General Conclusions.

48. To obtain a maximum amount and gross value of produce from a given amount of sewage, it should be applied in small quantities per acre, and in dry weather; but the great dilution of town sewage, its large daily supply at all seasons, and its greater amount in wet weather, when the land can least bear, or least requires, more water, render it quite inappropriate for application on a comprehensive scale to arable land for corn and other ordinary rotation crops.

49. Supposing arrangements were made for distributing sewage over a sufficiently large area to command a full value, both as manure and as water, at the most favourable periods of the year, the cost of main distribution would be very great, the application to the arable land would require to be chiefly by the expensive means of piping and hose and jet, instead of open runs, and but a

small proportion of the total sewage could be so used, leaving the remainder to be applied in large quantities to grass-land, at the less favourable periods of the year, and, of course, to realize a much lower value.

50. Having regard to the cost of distribution, it is probable that the most profitable mode of utilisation would be to limit the area by specially adapting the arrangements for the application of the greater part, if not the whole, to permanent or other grasses laid down to take it the year round, trusting to the occasional use to other crops within easy reach of the line or area so commanded, but relying mainly on the periodically broken up rye-grass land, and on the application to arable land of the solid manure resulting from the consumption of the sewaged grass, for obtaining other produce than milk and meat, by means of sewage.

51. It is probable that about 5,000 tons of sewage per acre, judiciously applied to grass-land properly laid down to receive it, would, in a great majority of cases, secure the most profitable utilisation.

52. Supposing an application of 5,000 tons of sewage per acre per annum to grass land, the purification of the water would doubtless be sufficient to admit of the drainage being turned into rivers without fear of detriment to fish; whilst any streams receiving such drainage instead of that direct from the towns would at any rate be vastly improved from their previous condition as a water supply; but whether the purification would be sufficient with such an application is a question which requires further experience and investigation to answer satisfactorily, and which will probably receive a different answer in different cases.

53. Assuming that the average dilution of the Metropolitan sewage, including rainfall and subsoil water, will amount to 100 tons per head per annum, 5,000 tons would represent the excretal and other matters of 50 average individuals; and a population of 3,000,000 would require about 60,000 acres constantly under irrigation.

54. The only records of exact quantitive results obtained on the application of town sewage to corn crops are those of the experiments of the Earl of Essex on wheat, and those of the experiments with oats at Rugby given in this Report, and in both cases the increase of produce represented a very high gross money return per ton of sewage employed. The circumstances of the experiments at Rugby were, however, quite exceptional; and, where the most extensive trials of the application of sewage to corn crops have been made with a view to profit, namely, at Watford, Rugby, and Alnwick, the practice has been abandoned; whilst neither at Edinburgh nor Croydon, where the best results have been obtained with grass, does the application to corn and other rotation crops constitute a part of the general system adopted.

55. Judging both from the results of the experiments, and from the experience of common practice, it is considered that the most

APPENDIX.

APPENDIX No. 1.

DETAILED RECORDS relating to the EXPERIMENTS made at RUGBY.

TABLE I.

DETAILED RECORD of the SEWAGE applied to PERMANENT GRASS LAND. SECOND SEASON 1861–2.

DATE.	Five-acre Field.					Ten-acre Field.				
	Average time taken to fill Gauge-tank (3·216 tons).	Time of application.	Sewage applied (calculated per acre). Plot 2. (Area ·99575 acre.)	Plot 3. (Area ·93061 acre.)	Plot 4. (Area 1·00512 acre.)	Average time taken to fill Gauge-tank (3·216 tons).	Time of application.	Sewage applied (calculated per acre). Plot 2. (Area ·9875 acre.)	Plot 3. (Area ·99558 acre.)	Plot 4. (Area 1·00019 acre.)
	Mins.	H. M.	Tons.	Tons.	Tons.	Mins.	H. M.	Tons.	Tons.	Tons.
Nov. 4	15·50	2 45	..	..	54·00	9·50	2 0	41·14	..	..
5	15·66	5 0	71·07	..	..	15·00	4 0	..	51·67	..
,,	14·33	6 15	..	90·41	..	11·50	2 0	..	33·70	..
,,	..	..	..	..	..	13·00	7 0	..	..	108·83
6	14·16	11 15	..	..	192·52	10·50	2 0	..	..	26·75
11	15·83	10 0	..	..	138·81	9·50	2 0	41·14	..	..
12	14·67	10 0	..	141·31	..	15·50	5 0	..	43·06	..
,,	..	..	..	..	..	11·50	2 0	..	33·70	..
,,	..	..	..	..	..	12·67	7 15	..	..	110·59
13	14·00	6 15	86·65	..	..	10·50	2 0	..	..	36·75
,,	13·00	4 0	..	..	59·07	..	..	..	..	..
14	..	..	..	..	..	9·50	2 0	..	40·79	..
15	..	..	..	..	..	11·50	2 0	33·98	..	..
16	..	..	..	..	..	11·50	2 0	..	..	33·55
18	14·50	9 15	..	..	122·47	..	..	..	..	..
19	15·16	9 45	..	133·32	..	13·50	5 0	..	71·76	..
,,	..	..	..	..	..	14·67	5 0	..	..	65·75
20	14·67	6 0	79·42	..	..	..	..	..	..	..
,,	14·34	4 0	..	..	53·55	..	..	..	..	..
25	14·16	9 45	..	..	132·19	..	..	..	..	..
26	15·00	9 45	..	134·75	..	14·50	5 0	..	66·61	..
,,	..	..	..	..	..	15·00	5 0	..	..	64·31
[illegible]	15·34	6 0	76·96	..	..	..	..	..	..	..
,,	14·67	4 0	..	..	52·34	..	..	..	..	..
Total	(14·42)	114 0	513·12	469·79	746·01	(12·61)	59 15	116·26	341·40	451·38
Dec. 2	14·00	9 0	..	..	133·41	..	..	..	..	..
3	14·16	9 45	..	142·74	..	13·67	5 0	71·47	..	..
,,	..	..	..	..	..	14·50	5 0	..	..	65·52
6	15·34	6 0	75·95	..	..	..	..	..	..	..
[illegible]	15·34	4 0	..	..	50·06	..	..	..	..	..
[illegible]	14·34	5 0	..	..	66·84	13·34	5 0	..	..	72·31
[illegible]	14·00	5 0	..	74·04	..	..	..	..	..	..
[illegible]	14·00	5 0	..	..	68·56	..	..	..	..	..
[illegible]	15·00	9 15	..	..	118·30	..	..	..	..	..
[illegible]	15·34	4 0	50·63	..	..	13·67	5 0	..	70·67	..
[illegible]	14·00	5 45	..	85·14	..	13·00	5 0	..	..	74·20
[illegible]	15·80	8 15	..	..	100·94	..	..	..	..	..
[illegible]	15·00	9 15	..	127·84	..	13·34	5 0	..	72·63	..
[illegible]	..	..	..	..	..	15·50	4 30	..	..	64·31
[illegible]	(14·66)	89 15	126·58	429·76	527·60	(13·66)	34 30	71·47	142·49	277·34

Table I.—*continued.*

Detailed Record of the Sewage applied to Permanent Grass La
Second Season 1861–2.

Dates.	Five-acre Field. Average Time taken to fill Gauge-tank (3·216 tons).	Five-acre Field. Time of application.	Five-acre Field. Sewage applied (calculated per acre). Plot 2. (Area ·99375 acre.)	Plot 3. (Area ·93061 acre.)	Plot 4. (Area 1·00512 acre.)	Ten-acre Field. Average Time taken to fill Gauge-tank (3·216 tons).	Ten-acre Field. Time of application.	Ten-acre Field. Sewage appl[ied] (calculated per [acre]). Plot 2. (Area [redacted] acre.)	Plot 3. (Area ·99553 acre.)
	Mins.	H. M.	Tons.	Tons.	Tons.	Mins.	H. M.	Tons.	Tons.
Jan. 1	15·00	8 30	45·81	..	..	..	..	..	..
6	15·16	9 45	..	..	123·47	..	..	..	..
7	15·16	9 45	..	125·32	..	12·00	4 45	[redacted]	..
„	..	..	..	..	..	12·00	5 0	..	..
8	15·00	5 45	74·43	..	..	..	..	..	..
„	15·34	4 0	..	..	50·06	..	..	..	..
13	14·50	9 45	..	..	130·09	..	..	..	..
14	14·67	9 45	..	137·78	..	12·00	5 0	..	80·73
„	..	..	..	..	..	12·34	5 0	..	..
15	14·34	6 0	81·24	..	..	..	..	..	..
„	15·34	4 0	..	..	50·06	..	..	..	..
21	21·25	5 45	..	56·00	..	..	..	..	..
23	16·34	5 0	50·43	..	..	..	..	..	..
„	16·00	5 0	..	..	50·30	..	..	..	..
27	15·53	9 45	..	..	118·24	..	..	..	..
28	15·50	9 45	..	130·40	..	12·34	5 0	..	75·61
„	..	..	..	..	..	12·50	5 0	..	..
30	15·50	5 0	63·64	..	..	..	..	..	..
„	14·67	4 0	..	..	52·34	..	..	..	..
Total -	(15·41)	103 30	333·04	487·50	583·25	(12·20)	29 45	77·36	159·24
Feb. 3	22·16	11 15	..	..	97·46	..	..	..	..
4	15·67	11 30	..	152·14	..	11·67	7 45	129·77	..
„	..	..	..	..	..	12·53	3 45	..	..
5	16·34	11 15	..	..	138·17	..	..	..	..
10	16·50	10 45	..	..	124·83	..	..	..	..
11	16·16	11 30	..	147·53	..	11·50	5 45	..	96·66
„	..	..	..	..	..	12·34	5 45	..	..
13	18·00	11 30	..	..	122·65	..	..	..	..
17	16·34	4 45	..	..	55·61	..	..	..	..
18	16·33	11 30	..	141·65	..	12·34	5 45	..	90·50
„	..	..	..	..	..	12·50	5 45	..	..
19	16·67	11 45	136·86	..	..	..	..	..	..
24	16·34	11 15	..	..	132·17	..	..	..	..
25	17·83	11 30	..	123·71	..	11·50	5 45	97·70	..
„	..	..	..	..	..	12·34	5 45	..	..
26	12·00	3 0	33·36	..	..	..	..	..	..
„	16·00	7 15	..	..	86·90	..	..	..	..
Total -	(17·08)	123 45	169·22	575·02	751·57	(11·98)	46 0	227·47	187·16
Mar. 3	16·00	11 15	..	..	134·98	..	..	..	..
4	15·00	11 30	..	133·44	..	12·00	5 45	..	93·84
„	..	..	..	..	..	11·34	5 45	..	..
5	16·34	6 45	80·21	..	..	..	..	..	..
„	17·34	3 45	..	..	41·63	..	..	..	..
17	(8 tanks*)	11 0	..	..	25·60	..	..	..	..
21	16·00	11 30	..	149·00	..	12·00	5 45	..	93·84
„	..	..	..	..	..	11·83	[redacted]	..	..
22	14·50	4 15	80·91	..	..	..	..	..	..
„	12·67	5 45	..	..	80·75	..	..	..	..
24	..	..	..	..	..	12·00	4 45	..	..
25	..	..	..	..	..	11·83	11 30	..	186·86
26	..	..	..	..	..	12·00	5 45	109·91	..
„	..	..	..	..	..	11·67	4 15	..	..
27	14·67	11 0	..	..	169·95	..	..	..	..
28	12·67	11 30	..	174·40	..	..	..	..	..
29	12·33	6 45	93·22	..	..	..	..	..	..
„	14·00	3 45	..	..	51·48	..	..	..	..
31	..	..	..	..	..	12·16	11 30	..	..
Total -	(16·73)	[redacted]	333·44	465·84	473·28	(11·86)	62 45	109·91	374·92

* *When the number of tanks is given, the flow was too slow and irregular to estimate t[he] average time taken to fill the gauge-tank, and therefore the actual number of ta[nks] counted.*

Table I.—*continued.*

Detailed Record of the Sewage applied to Permanent Grass Land. Second Season 1861–2.

Date.	Five-acre Field. Average Time taken to fill Gauge-tank (3·216 tons).	Five-acre Field. Time of application.	Five-acre Field. Sewage applied (calculated per acre). Plot 2. (Area ·93375 acre.)	Plot 3. (Area ·98061 acre.)	Plot 4. (Area 1·00612 acre.)	Ten-acre Field. Average Time taken to fill Gauge-tank (3·216 tons).	Ten-acre Field. Time of application.	Ten-acre Field. Sewage applied (calculated per acre). Plot 2. (Area ·9875 acre.)	Plot 3. (Area ·99583 acre.)	Plot 8. (Area 1·00019 acre.)
	Mins.	H. M.	Tons.	Tons.	Tons.	Mins.	H. M.	Tons.	Tons.	Tons.
April 1	..	..	..	..	..	11·50	11 30	..	190·76	..
2	..	..	..	..	..	[illegible]	6 45	106·97	..	..
"	..	..	..	..	..	11·33	4 15	..	..	72·87
3	15·10	11 30	..	..	145·63	..	..	..	..	..
4	15·50	11 30	..	153·60	..	..	..	..	..	..
5	15·67	6 45	83·04	..	..	..	..	..	..	..
"	15·00	5 45	..	..	35·20	..	..	..	..	..
7	..	..	..	..	..	11·60	10 15	..	..	167·58
8	..	..	..	..	..	12·16	11 30	..	182·24	..
9	..	..	..	..	..	12·33	5 45	91·12	..	..
"	..	..	..	..	..	11·50	5 45	..	..	62·01
10	15·20	10 15	..	..	129·46	..	..	..	..	..
11	14·73	7 45	..	106·93	..	..	..	..	..	..
12	15·67	10 15	..	..	125·58	..	..	..	..	..
14	..	..	..	..	..	12·33	10 30	..	..	164·20
15	..	..	..	..	..	12·33	11 30	..	190·71	..
16	..	..	..	..	..	12·33	6 45	106·97	..	..
"	..	..	..	..	..	11·67	4 30	..	..	74·39
17	17·60	10 0	..	..	109·06	..	..	..	..	..
19	15·67	4 0	49·56	..	..	..	..	..	..	..
"	15·33	6 45	..	91·20	..	..	..	..	..	..
21	..	..	..	..	..	12·16	10 30	..	..	166·50
22	..	..	..	..	..	12·33	[illegible]	..	190·71	..
23	..	..	..	..	..	12·33	6 45	106·97	..	..
"	..	..	..	..	..	11·50	3 30	..	..	58·71
24	16·00	11 0	..	..	131·96	..	..	..	..	..
25	16·00	11 30	..	140·00	..	..	..	..	..	..
26	16·67	6 45	75·62	..	..	..	..	..	..	..
"	16·67	5 45	..	..	45·19	..	..	..	..	..
28	..	..	..	..	..	12·67	4 45	..	..	72·53
29	..	..	..	..	..	13·50	11 30	..	165·05	..
30	..	..	..	..	..	13·67	6 45	96·40	..	..
"	..	..	..	..	..	13·00	2 30	..	..	37·10
Total	(15·75)	114 30	211·83	508·00	720·12	(12·26)	144 45	506·53	903·47	876·27
May 1	17·67	4 45	..	..	61·61	..	..	..	..	..
2	20·67	4 45	44·63	..	..	..	..	..	..	..
"	21·00	6 45	..	66·63	..	..	..	..	..	..
3	20·67	10 30	..	..	97·53	..	..	..	..	..
5	..	..	..	..	..	13·16	10 30	..	..	153·95
6	..	..	..	..	..	13·50	4 30	..	64·59	..
"	..	..	..	..	..	13·67	5 45	..	..	81·15
7	..	..	..	..	..	13·33	5 45	64·20	..	..
"	..	..	..	..	..	13·33	5 0	..	..	72·36
8	15·67	11 30	..	..	86·00	..	..	..	..	..
9	15·67	11 30	..	93·87	..	..	..	..	..	..
10	15·00	6 15	46·54	..	..	..	..	..	..	..
"	15·33	4 15	..	..	34·97	..	..	..	..	..
12	..	..	..	..	..	15·40	3 45	..	..	109·63
13	..	..	..	..	..	14·67	5 45	..	75·94	..
"	..	..	..	..	..	17·00	6 0	..	..	65·09
14	..	..	..	..	..	16·00	4 45	58·01	..	..
"	..	..	..	..	..	15·67	6 45	..	..	102·78
15	24·50	11 30	..	..	99·11	..	..	..	..	..
16	16·00	11 30	..	149·00	..	..	..	..	..	..
17	15·50	4 0	50·11	..	..	..	..	..	..	..
"	16·00	6 45	..	..	80·99	..	..	..	..	..
19	..	..	..	..	..	11·83	10 30	..	..	171·23
20	..	..	..	..	..	12·67	5 45	..	87·93	..
"	..	..	..	..	..	13·33	5 45	..	..	83·22
21	..	..	..	..	..	11·66	3 0	50·97	..	..
"	..	..	..	..	..	12·33	5 45	..	..	89·97
22	19·00	11 30	..	..	115·20	..	..	..	..	..
23	16·33	11 30	..	141·65	..	..	..	..	..	..
24	17·00	5 45	65·66	..	..	..	..	..	..	..
"	17·00	4 45	..	..	53·64	..	..	..	..	..
26	..	..	..	..	..	11·83	10 30	..	..	171·23
27	..	..	..	..	..	11·33	11 30	..	186·67	..
28	..	..	..	..	..	11·67	5 45	94·30	..	..
"	..	..	..	..	..	11·83	5 45	..	..	97·91
29	20·00	11 30	..	..	110·39	..	..	..	..	..
30	1[illegible]·17	11 30	..	131·30	..	..	..	..	..	..
31	15·00	6 45	72·82	..	..	..	..	..	..	..
"	17·33	5 45	..	..	41·54	..	..	..	..	..
Total	(19·56)	161 0	251·77	551·35	762·97	(12·90)	132 45	[illegible]·55	[illegible]·13	[illegible]

[redacted]

Table I.—*continued.*

Detailed Record of the Sewage applied to Permanent Grass Land. Second Season 1861–2.

Dates.	Five-acre Field. Average time taken to fill Gauge-tank (3·216 tons).	Five-acre Field. Time of application.	Five-acre Field. Sewage applied (calculated per acre). Plot 2. (Area ·99675 acre.)	Five-acre Field. Sewage applied (calculated per acre). Plot 3. (Area ·93081 acre.)	Five-acre Field. Sewage applied (calculated per acre). Plot 4. (Area 1·00512 acre.)	Ten-acre Field. Average time taken to fill Gauge-tank (3·216 tons).	Ten-acre Field. Time of application.	Ten-acre Field. Sewage applied (calculated per acre). [redacted] (Area ·9875 acre.)	Ten-acre Field. Sewage applied (calculated per acre). Plot 3. (Area ·99668 acre.)	Ten-acre Field. Sewage applied (calculated per acre). Plot 4. (Area 1·00019 acre.)
	Mins.	H. M.	Tons.	Tons.	Tons.	Mins.	H. M.	Tons.	Tons.	Tons.
June 2	..	..	..	..	..	13·00	4 45	..	..	70·49
3	..	..	..	..	..	12·00	7 45	..	125·14	..
"	..	..	..	..	..	12·00	3 45	..	..	60·29
4	..	..	..	..	..	13·33	5 45	84·29	..	..
"	..	..	..	..	..	13·00	5 45	..	..	83·33
5	15·50	11 30	..	..	117·43	..	..	..	..	..
6	16·83	11 30	..	141·65	..	..	..	..	..	..
7	17·00	6 45	77·10	..	..	..	..	..	..	..
"	16·33	3 45	..	..	44·09	..	..	..	..	..
9	..	..	..	..	..	10·50	4 0	..	73·81	..
"	..	..	..	..	..	12·00	6 45	..	..	105·52
10	..	..	..	..	..	14·00	9 15	..	128·09	..
11	..	..	..	..	..	12·67	5 45	86·68	..	..
"	..	..	..	..	..	13·00	5 45	..	..	85·33
12	16·83	11 30	..	..	131·18	..	..	..	..	..
13	15·00	2 0	..	23·03	..	..	..	..	..	..
Total -	(17·30)	47 0	77·10	164·68	292·70	(12·61)	69 15	172·97	326·97	404·96
July 5	36·50	4 0	..	..	21·04	17·75	7 0	..	..	76·08
7	..	..	..	..	..	14·00	11 0	..	..	151·58
8	..	..	..	..	..	11·33	11 0	..	168·11	..
9	..	..	..	..	..	11·17	12 0	260·92	..	..
10	16·00	12 0	..	..	143·98	12·00	12 0	..	..	192·98
11	16·50	12 0	..	150·77	..	12·00	12 0	..	196·70	..
12	15·67	11 0	136·30	..	..	11·83	11 0	..	..	179·89
14	15·67	11 0	..	..	134·76	11·67	11 0	..	..	181·85
15	15·50	12 0	..	160·49	..	11·67	12 0	..	199·24	..
16	15·50	12 0	150·33	..	..	12·33	12 0	190·17	..	..
17	16·16	12 0	..	..	142·56	13·50	12 0	..	..	171·46
18	16·00	11 0	..	146·17	..	11·00	11 0	..	188·74	..
19	15·33	11 0	..	..	137·75	11·67	11 0	..	..	181·65
21	14·83	11 0	..	..	143·40	11·67	11 0	..	..	181·62
22	15·50	4 45	..	63·53	..	11·00	4 45	..	63·67	..
23	16·33	12 0	142·60	..	..	11·33	12 0	..	205·29	..
24	15·50	12 0	..	..	146·63	12·00	12 0	196·40	..	..
25	13·50	12 0	..	160·40	..	11·50	12 0	..	..	201·31
26	14·17	11 0	150·73	..	..	12 50	5 0	..	..	[illegible]·17
28	16·33	11 0	..	..	137·75	12·00	3 0	..	..	83·13
29	15·00	11 30	..	158·93	..	11·66	12 0	..	..	190·56
30	14·67	12 0	..	..	157·04	11·50	12 0	..	202·18	..
31	14·60	12 0	..	..	157·79	12·20	12 0	..	..	169·76
Total -	(15·59)	217 15	580·06	840·38	1323·70	(12·00)	239 45	595·49	1255·92	2016·[illegible]
Aug. 1	14·67	12 0	..	..	157·01	11·40	12 0	..	206·96	..
2	14·67	11 0	..	..	143·93	11·25	11 0	..	..	188·[illegible]
4	14·67	11 0	..	..	143·93	11·60	11 0	..	..	182·[illegible]
5	14·67	12 0	..	..	157·04	11 00	12 0	..	200·44	..
6	13·33	12 0	161·99	..	..	11·00	12 0	..	..	190·[illegible]
7	15·00	12 0	..	..	153·68	11·00	12 0	202·14	..	..
8	15·17	12 0	..	..	151·98	11·50	12 0	..	200·44	..
9	13·33	11 0	..	148·75	..	11·50	11 0	..	..	179·[illegible]
11	..	..	..	..	..	11·00	5 0	..	..	[illegible]
12	..	..	..	..	..	12·00	12 0	..	196·76	..
13	..	..	..	..	..	11·00	11 30	..	..	191·[illegible]
14	15·33	12 0	..	..	150·28	..	..	..	..	..
15	15·33	12 0	..	162·27	..	..	..	..	..	..
16	15·00	7 30	..	..	96 99	..	..	..	..	..
18	..	..	..	..	..	12·40	11 0	..	..	171·[illegible]
19	..	..	..	..	..	11·50	12 0	..	208·16	..
20	15·00	12 0	..	..	153·58	..	..	..	..	..
21	15·00	12 0	..	165·84	..	..	..	..	..	..
22	15·67	11 0	..	..	134·76	11·50	11 0	..	..	184·[illegible]
23	14·83	12 0	157·12	..	..	12·00	12 0	196·40	..	..
Total -	(15·04)	171 30	309·11	476·86	1442·03	(11·65)	167 30	397·84	1090·78	1285·[illegible]

Table I.—*continued.*

Detailed Record of the Sewage applied to Permanent Grass Land. Second Season 1861–2.

Dates.	Five-acre Field. Average time taken to fill Gauge-tank (3·216 tons).	Five-acre Field. Time of application.	Five-acre Field. Sewage applied (calculated per acre). Plot 2. (Area ·99375 acre.)	Plot 3. (Area ·93081 acre.)	Plot 4. (Area 1·00512 acre.)	Ten-acre Field. Average time taken to fill Gauge-tank (3·216 tons).	Ten-acre Field. Time of application.	Ten-acre Field. Sewage applied (calculated per acre). Plot 2. (Area ·9875 acre.)	Plot 3. (Area ·99588 acre.)	Plot 4. (Area 1·00019 acre.)
	Mins.	H. M.	Tons.	Tons.	Tons.	Mins.	H. M.	Tons.	Tons.	Tons.
Sept. 1	14·83	11 0	..	..	142·40	11·50	11 0	..	..	184·53
2	14·83	12 0	..	167·74	..	11·33	12 0	..	205·22	..
8	15·50	11 0	..	..	136·24	..	..	..	..	..
9	15·33	12 0	..	162·27	..	..	..	..	..	..
15	15·67	11 0	..	..	134·76	11·67	11 0	..	..	181·85
16	14·67	6 0	79·42	..	..	12·17	12 0	..	191·05	..
"	15·00	6 0	..	82·92	..	..	..	..	..	..
22	17·00	3 0	..	..	33·88	12·50	3 0	..	..	46·30
23	16·33	6 0	..	76·17	..	13·20	12 0	177·64	..	..
"	18·33	6 0	..	..	62·84	..	..	..	..	..
29	17·83	11 0	..	..	118·44	12·20	11 0	..	..	173·95
30	18·50	12 0	..	134·47	..	12·17	12 0	..	..	190·23
Total .	(15·99)	107 0	79·42	623·57	628·56	(12·03)	84 0	177·64	396·27	776·86
Oct. 6	24·60	11 0	..	..	85·84	23·40	11 0	..	..	90·69
7	28·67	12 0	..	86·77	..	26·20	12 0	..	88·74	..
13	16·00	11 0	...	..	131·98	11·50	11 0	..	..	184·54
14	16·00	6 0	72·82	..	..	11·16	12 0	..	208·34	..
"	16·33	6 0	..	76·17	..	..	..	..	..	..
20	..	..	..	..	..	12·33	11 0	..	..	172·11
21	.	..	..	..	..	12·67	11 0	..	168·22	..
22	..	..	..	..	..	12·50	11 0	171·95	..	..
23	15·33	11 0	..	..	137·75	..	..	..	..	..
24	15·25	8 0	..	108·75	..	..	..	..	..	..
25	16·00	11 0	..	..	131·98	..	..	..	..	..
27	..	..	..	..	..	12·33	5 15	83·20	..	..
"	..	..	..	..	..	12·00	1 15	..	20·18	..
"	..	..	..	..	..	12·33	4 30	..	..	70·41
28	16·00	11 0	..	..	131·98	..	..	..	..	..
29	16·25	9 0	..	114·81	..	..	..	..	..	..
"	16·50	3 0	..	..	34·90	..	..	..	..	..
30	16·00	12 0	145·63	..	..	..	..	..	..	..
31	16·00	5 30	66·75	..	..	..	..	..	..	..
"	16·33	6 30	..	..	76·42	..	..	..	..	..
Total .	(17·23)	123 0	285·20	386·50	730·85	(13·86)	90 0	255·15	485·48	517·75

TABLE II.

DETAILED RECORD of the SEWAGE applied to PERMANENT GRASS LAND. THIRD SEASON 1862–3.

DATES.	Five-acre Field. Average time taken to fill Gauge-tank (5·216 tons).	Five-acre Field. Time of application.	Five-acre Field. Sewage applied (calculated per acre). Plot 2. (Area ·99375 acre.)	Plot 3. (Area ·98061 acre.)	Plot 4. (Area 1·00512 acre.)	Ten-acre Field. Average time taken to fill Gauge-tank (3·216 tons).	Ten-acre Field. Time of application.	Ten-acre Field. Sewage applied (calculated per acre). Plot 2. (Area ·9875 acre.)	Plot 3. (Area ·99688 acre.)	Plot 4. (Area 1·00019 acre.)
	Mins.	H. M.	Tons.	Tons.	Tons.	Mins.	H. M.	Tons.	Tons.	Tons.
Nov. 1	17·00	11 0	..	..	134·29	..	..	..	..	..
3	..	..	..	..	..	12·67	4 0	..	..	60·91
4	..	..	..	..	..	12·50	10 0	..	155·01	..
5	..	..	..	..	..	12·83	10 0	..	..	150·37
6	16·67	10 0	..	..	115·16	..	..	..	..	..
7	16·33	10 0	..	126·95	..	..	..	..	..	..
8	15·83	10 0	..	..	121·27	..	..	..	..	..
10	..	..	..	..	..	12·50	10 0	..	..	149·91
11	..	..	..	..	..	12·67	10 0	..	152·93	..
12	..	..	..	..	..	13·00	10 0	150·31	..	..
13	16·83	10 0	..	..	114·07	..	..	..	..	..
14	16·00	10 0	..	129·56	..	..	..	..	..	..
15	16·25	7 30	89·62	..	..	..	..	..	..	..
17	..	..	..	..	..	12·60	9 30	..	..	145·46
18	..	..	..	..	..	13·00	10 0	..	140·06	..
19	..	..	..	..	..	12·50	10 0	..	..	154·34
20	17·00	10 0	..	..	112·98	..	..	..	..	..
21	16·33	10 0	..	126·95	..	..	..	..	..	..
22	15·40	9 0	..	..	112·19	..	..	..	..	..
24	..	..	..	..	..	12·33	7 30	..	..	117·35
25	..	..	..	..	..	12·40	9 0	..	140·63	..
26	..	..	..	..	..	12·40	8 45	137·88	..	..
27	16·60	9 15	..	..	106·98	..	..	..	..	..
28	16·00	10 0	..	129·56	..	..	..	..	..	..
29	16·00	9 15	112·26	..	..	..	..	..	..	..
Total -	(16·33)	126 0	201·88	512·02	806·82	(12·71)	108 45	288·19	587·63	771·34
Dec. 1	..	..	..	..	..	12·50	10 0	..	..	164·34
2	..	..	..	..	..	12·50	10 0	..	156·01	..
3	..	..	..	..	..	12·40	9 0	..	..	140·05
4	16·67	10 0	..	..	115·16	..	..	..	..	..
5	16·50	10 0	..	125·64	..	..	..	..	..	..
6	16·67	10 0	..	..	115·16	..	..	..	..	..
9	..	..	..	..	..	12·40	8 0	..	..	124·47
10	..	..	..	..	..	12·40	9 0	..	140·63	..
11	10·00	6 0	..	..	68·99	..	..	..	..	..
12	17·00	9 45	..	92·31	..	..	..	..	..	..
13	17·00	10 0	114·29	..	..	..	..	..	..	..
15	..	..	..	..	..	12·00	10 0	..	..	160·77
16	..	..	..	..	..	11·67	10 0	..	166·05	..
17	..	..	..	..	..	11·60	9 0	161·61	..	..
18	17·00	10 0	..	..	112·93	..	..	..	..	..
19	19·33	10 0	..	107·24	..	..	..	..	..	..
20	18·60	9 0	..	..	92·80	..	..	..	..	..
22	..	..	..	..	..	11·67	10 0	..	..	165·32
23	..	..	..	..	..	11·83	10 0	..	165·79	..
24	..	..	..	..	..	11·60	9 0	..	..	149·69
Total -	(17·34)	81 45	114·29	315·19	590·15	(12·04)	104 0	161·61	625·46	894·61
Jan. 5	..	..	..	..	..	11·67	10 0	..	..	165·32
6	..	..	..	..	..	12·00	10 0	142·34	..	..
7	..	..	..	..	..	11·40	9 0	..	..	152·21
8	17·33	10 0	112·04	..	..	..	..	..	..	..
9	16·33	10 0	..	..	117·56	..	..	..	..	..
10	16·67	10 0	116·48	..	..	..	..	..	..	..
12	..	..	..	..	..	11·83	10 0	..	..	163·08
13	..	..	..	..	..	11·67	10 0	..	166·66	..
14	..	..	..	..	..	11·67	10 0	..	..	165·38
15	17·33	10 0	..	..	107·67	..	..	..	..	..
16	16·00	9 0	..	111·08	..	..	..	..	..	..
17	16·17	10 0	..	..	118·72	..	..	..	..	..
19	..	..	..	..	..	12·00	[illegible]	..	..	40·19
20	..	..	..	..	..	12·00	10 0	..	161·47	..
[illegible]	..	..	..	..	..	11·83	10 0	165·18	..	..
22	16·33	10 0	..	..	117·56	..	..	..	..	..
23	16·00	10 0	..	129·56	..	..	..	..	..	..
24	15·33	10 0	122·66	..	..	..	..	..	..	..
26	..	..	..	..	..	11·83	10 0	..	..	163·08
27	..	..	..	..	..	12·50	7 0	..	106·60	—
28	..	..	..	..	..	11·83	10 0	165·60	..	..
29	16·67	10 0	..	134·56	..	..	..	..	..	..
30	16·17	10 0	..	..	118·72	..	..	..	..	..
31	16·67	10 0	..	134·56	..	..	..	..	..	..
Total	(16·55)	110 0	351·18	460·34	580·28	(11·82)	108 30	493·62	435·08	[illegible]

36. Italian rye grass, in the condition as cut, was also found to be more succulent and to contain less solid matter when grown with sewage than without it; but the proportion of dry substance diminished less as the season advanced in its case than in that of the meadow grass.

37. The proportion of nitrogenous substance (and also of impure waxy or fatty matter) was much greater in the solid matter of the sewaged, than in that of the unsewaged grass. The proportion of nitrogenous substance was also much higher in the solid matter of the grass grown towards the end than earlier in the season. The proportion of indigestible woody fibre was much about the same in the dry substance of the unsewaged and of the sewaged grass. It progressively diminished as the season advanced, and was generally lower in the dry substance of the Italian rye than in that of the meadow grass.

38. A given amount of the dry substance of grass grown in a cold and wet season, or during the cold and wet periods of the year, generally contains more nitrogenous substance, but is less productive than that of grass grown in more genial weather.

39. The greater productiveness in milk and increase of a given amount of the solid matter of the sewaged grass appears to depend more on a favourable condition of maturation, digestibility, and assimilability, of the constituents, than on the actual per-centage amount of any of those determined, and above enumerated.

Effects of Sewage on the mixed Herbage of Grass Land.

40. The effect of sewage irrigation on the mixed herbage of grass land is to develop the Graminaceous plants chiefly, nearly to exclude the Leguminous, and to reduce the prevalence of miscellaneous or weedy plants, but much to encourage individual species.

41. Among the grasses which have been observed to be the most encouraged by sewage are (according to locality or other circumstances) rough meadow grass, couch grass, rough cock's foot, woolly soft grass, and perennial rye grass; two or three only remaining in any considerable proportion after sewage has been liberally applied for some years.

42. The produce of sewage irrigated meadows being generally cut or grazed very young, the tendency which the great luxuriance of a few very free growing grasses has to give a coarse and stemmy later growth is not an objection as in the case of meadows left for hay; a given weight of the dry or solid substance of the more simple sewaged grass being, when consumed green, more productive than an equal weight of that of the more complex unsewaged herbage.

Composition of the Milk from the unsewaged and the sewaged Grass.

43. Although more milk was obtained from a given weight of the dry or solid substance of sewaged than of unsewaged grass, there was comparatively little difference in the composition or

Table II.—*continued.*

Detailed Record of the Sewage applied to Permanent Grass Land. Third Season 1862–3.

Dates.	Five-acre Field.					Ten-acre Field.				
	Average time taken to fill Gauge-tank (3·216 tons).	Time of application.	Sewage applied (calculated per acre).			Average time taken to fill Gauge-tank (3·216 tons).	Time of application.	Sewage applied (calculated per acre).		
			Plot 2. (Area ·99375 acre.)	Plot 3. (Area ·99061 acre.)	Plot 4. (Area 1·00312 acre.)			Plot 2. (Area ·9875 acre.)	Plot 3. (Area ·99688 acre.)	Plot 4. (Area 1·00019 acre.)
	Mins.	H. M.	Tons.	Tons.	Tons.	Mins.	H. M.	Tons.	Tons.	Tons.
May 1	..	..	..	..	..	11·83	12 0	..	..	195·70
4	28·80	10 30	..	..	69·09	..	..	..	..	..
5	28·83	11 15	..	80·89	..	..	..	..	..	..
6	27·67	12 0	..	..	83·26	..	..	..	..	..
7	..	..	..	..	..	11·67	12 0	..	..	198·38
8	..	..	..	..	..	11·67	12 0	..	199·24	..
12	35·33	11 15	..	..	61·13	..	..	..	..	..
13	24·17	11 15	90·38	..	..	..	..	..	..	..
14	..	..	..	..	..	11·80	9 30	..	..	155·32
15	..	..	..	..	..	13·50	2 45	39·81	..	..
18	16·67	5 0	..	62·18	..	..	..	..	..	..
19	16·50	12 0	..	..	139·63	..	..	..	..	..
20	16·33	12 0	..	152·31	..	..	..	..	..	..
27	16·33	5 0	..	..	59·78	..	..	..	..	..
28	16·67	12 0	..	149·23	..	11·33	12 0	..	205·22	..
29	16·17	12 0	..	..	142·47	12·00	12 0	..	..	193·92
30	16·17	10 30	..	134·61	..	11·40	10 30	..	178·46	..
Total -	(20·28)	124 45	90·38	579·23	555·25	(11·72)	82 45	39·81	582·92	743·32
June 1	16 00	11 0	..	..	131·98	12·00	11 0	..	177·61	..
2	16·50	12 0	..	159·77	..	11·83	12 0	..	..	195·70
3	20·00	12 0	..	..	115·19	11·67	12 0	..	199·24	..
4	21·17	12 0	110·07	..	..	11·67	12 0	..	..	198·38
5	23·00	12 0	..	..	100·10	11·50	12 0	..	202·18	..
6	17·20	10 30	118·54	..	..	12·17	10 30	..	..	168·45
8	16·25	9 45	..	..	115·19	..	..	..	..	..
9	17·80	12 0	..	130·76	..	..	..	..	..	..
10	15·30	12 0	150·33	..	..	..	..	..	..	..
11	..	..	..	..	..	11·83	12 0	..	106·54	..
12	..	..	..	..	..	12·00	12 0	..	..	192·98
15	17·00	9 45	111·36	..	..	..	..	..	..	..
16	16·83	12 0	..	147·81	..	..	..	..	..	..
17	17·00	12 0	137·06	..	..	..	..	..	..	..
18	..	..	..	..	..	11·67	12 0	..	199·24	..
19	..	..	..	..	..	11·83	11 30	189 85	..	..
22	16·00	11 0	133·49	..	..	..	..	..	..	..
23	15·67	7 45	..	103 53	..	..	..	..	..	..
24	17·17	12 0	135·71	..	..	..	..	..	..	..
25	..	..	..	..	..	12·00	12 0	195·40	..	..
26	..	..	..	..	..	11·83	12 0	..	..	195·70
Total -	(17·41)	107 45	896·56	540·87	462·53	(11·83)	141 0	385·35	974·81	949·16
July 1	19·17	12 0	..	..	120·17	..	..	..	..	..
2	..	..	..	..	..	12·00	12 0	..	..	192·98
3	..	..	..	..	..	12 20	11 0	176·18	..	..
6	17·67	10 30	..	..	114·08	..	..	..	..	..
7	..	..	..	..	..	12·33	11 30	182·25	..	..
8	17·17	11 30	..	..	123·86	..	..	..	..	..
9	..	..	..	..	..	11·75	8 45	..	..	148·67
10	16·40	9 45	..	..	114·13	..	..	..	..	..
13	17·67	10 30	..	..	114·06	..	..	..	..	..
14	17·33	11 30	..	137·36	..	..	..	..	..	..
15	18·00	9 0	..	..	93·99	..	..	..	..	..
16	..	..	..	..	..	11·25	8 0	..	..	137·19
17	..	..	..	..	..	13·25	8 0	..	..	125·90
20	16·17	11 0	..	141·02	..	..	..	..	..	..
21	17·80	9 15	100·90	..	..	..	..	..	..	..
22	16·83	12 0	..	147·81	..	..	..	..	..	..
23	..	..	..	..	..	12·33	12 0	..	188·57	..
24	..	..	..	..	..	11·80	11 0	..	..	179·36
27	17·50	10 15	..	..	112·44	..	..	..	..	..
28	17·30	10 30	..	..	113·25	..	..	..	..	..
29	17·67	6 15	..	..	67·90	..	..	..	..	..
30	..	..	..	..	..	12·40	10 0	..	156·26	..
31	..	..	..	..	..	11·67	8 0	133·96	..	..
Total -	(17·44)	164 0	100·90	426·39	980·63	(12·02)	100 15	492·39	344·83	779·53

Table II.—*continued.*

Detailed Record of the Sewage applied to Permanent Grass Land. Third Season 1862–3.

Dates.	Five-acre Field. Average time taken to fill Gauge-tank (3·216 tons).	Time of application.	Sewage applied (calculated per acre). Plot 2. (Area ·99375 acre.)	Plot 3. (Area ·99081 acre.)	Plot 4. (Area 1·06312 acre.)	Ten-acre Field. Average time taken to fill Gauge-tank (3·216 tons).	Time of application.	Sewage applied (calculated per acre). Plot 2. (Area ·9875 acre.)	Plot 3. (Acre ·99688 acre.)	Plot 4. (Area 1·00019 acre.)
	Mins.	H. M.	Tons.	Tons.	Tons.	Mins.	H. M.	Tons.	Tons.	Tons.
Aug. 3	14·00	9 30	..	..	30·00	..	..	..	..	..
4	14·00	12 0	..	..	143·98	..	..	..	..	..
5	17·17	12 0	..	144·88	..	..	..	..	..	..
6	..	..	..	..	..	15·00	12 0	..	..	178·08
7	..	..	..	..	..	14·00	10 45	160·04	..	..
10	16·00	10 0	..	..	119·99	..	..	..	..	..
11	17·33	12 0	..	143·55	..	..	..	..	..	..
12	19·67	7 0	..	..	68·33	..	..	..	..	..
17	16·33	11 0	..	..	129·33	..	..	..	..	..
18	18·40	10 45	..	121·12	..	..	..	..	..	..
19	23·00	1 30	..	..	12·52	..	..	..	..	..
20	..	..	..	..	..	12·33	11 0	..	..	179·11
21	..	..	..	..	..	13·40	11 0	..	..	171·14
[illegible]	15·40	10 0	..	..	124·66	..	..	..	..	..
25	15·50	8 0	..	..	99·00	..	..	..	..	..
26	13·80	12 0	..	..	124·53	..	..	..	..	..
27	..	..	..	..	..	11·83	12 0	..	..	196·70
31	17·60	10 15	..	..	111·81	..	..	..	..	..
Total -	(17·00)	119 0	..	409·55	984·22	(12·65)	56 45	160·04	..	717·08
Sept. 1	15·83	12 0	..	167·15	..	..	..	..	..	..
2	16·33	12 0	..	..	125·68	..	..	..	..	..
3	..	..	..	..	..	13·40	10 15	..	..	147·07
[illegible]	..	..	..	..	..	13·50	12 0	..	196·01	..
7	17·50	11 0	..	..	130·67	..	..	..	..	..
8	16·50	11 30	..	144·48	..	..	..	..	..	..
9	17·00	12 0	..	..	135·51	..	..	..	..	..
10	..	..	..	..	..	12·00	9 0	..	145·83	..
11	..	..	..	..	..	13·50	7 0	..	..	100·08
15	16·00	12 0	145·63	..	..	..	..	..	..	..
16	16·75	8 15	..	103·11	..	..	..	..	..	..
17	..	..	..	..	..	13·00	7 30	..	..	111·30
18	..	..	..	..	..	12·80	9 15	..	[illegible]	..
21	19·00	11 0	..	..	111·15	..	..	..	..	..
22	17·40	10 30	..	135·10	..	..	..	..	..	..
23	18·75	6 0	..	88·45	..	..	..	..	..	..
24	..	..	..	..	..	12·75	9 0	..	..	136·18
25	..	..	..	..	..	13·00	10 30	..	169·54	..
26	17·83	11 0	..	..	118·44	..	..	..	..	..
29	18·00	12 0	139·45	..	..	..	..	..	..	..
30	19·67	6 0	..	..	48·60	..	..	..	..	..
Total -	(17·39)	136 15	275·08	617·29	660·25	(12·68)	74 30	..	649·39	495·08
Oct. 1	..	..	..	..	..	12·33	12 0	..	..	167·76
2	..	..	..	..	..	13·50	8 0	115·70	..	..
3	16·30	6 30	..	81·07	..	..	..	..	..	..
„	16·50	4 30	..	..	52·80	..	..	..	..	..
6	16·00	9 30	..	..	101·33	..	..	..	..	..
7	19·25	8 45	..	..	87·20	..	..	..	..	..
8	..	..	..	..	..	11·50	10 30	..	..	171·67
9	..	..	..	..	..	12·33	12 0	..	188·57	..
11	17·67	11 0	..	..	119·51	..	..	..	..	..
13	15·83	12 0	..	..	136·88	..	..	..	..	..
14	17·67	12 0	..	140·78	..	..	..	..	..	..
15	..	..	..	..	..	13·00	12 0	..	..	178·08
16	..	..	..	..	..	12·00	12 0	..	193·76	..
17	..	..	..	..	..	12·50	11 0	171·95	..	..
19	17·00	5 0	57·11	..	..	..	..	..	..	..
„	18·00	6 0	..	..	63·99	..	..	..	..	..
20	17·17	12 0	..	..	134·17	..	..	..	..	..
21	17·33	6 0	..	..	66·47	12·00	3 45	..	..	44·21
22	..	..	..	..	..	14 20	8 45	..	..	118·83
23	..	..	..	..	..	13·67	6 0	65·77	..	..
„	..	..	..	..	..	15·00	6 0	..	77·50	..
24	20·00	1 0	..	10·37	..	11·00	1 0	17·76	..	..
„	16·00	4 45	..	..	56·99	14·00	7 0	..	..	96·46
Total -	(17·46)	99 0	57·11	253·24	818·96	(12·61)	109 0	391·27	469·83	797·08

Table III.

Detailed Record of the Amounts of **Green Produce** obtained in t
ments on **Permanent Grass Land.**

Second Season 1862.

Dates of Cuttings.	Green Grass obtained (calculated per acre).						
	Five-acre Field.				Ten-acre Field.		
	Without Sewage.	With Sewage.			Without Sewage.	With Sew	
	Plot 1.*	Plot 2.	Plot 3.	Plot 4.	Plot 1.*	Plot 2.	Plot 3.
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs.
		1st Crop.	1st Crop.	1st Crop.	1st Crop.	1st Crop.	1st Crop
May 1	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..
5	..	..	..	..	..	..	..
6	..	..	..	..	..	..	..
7	..	..	..	..	..	..	0 16 0 2
8	..	..	..	0 8 0 15	..	..	0 13 2
9	..	..	..	0 8 2 14	..	..	1 0 2
10	..	..	..	1 8 1 15	..	..	1 18 2 2
12	..	..	..	0 13 1 22	..	0 16 3 24	..
13	..	..	..	0 11 3 22	..	..	..
14	..	..	..	0 12 0 26	..	..	..
15	..	..	..	0 12 2 20	..	..	..
16	..	..	..	0 11 1 27	..	..	..
17	..	..	..	1 5 2 0	..	..	1 12 0 1
19	..	..	..	0 14 1 19	..	..	0 14 2
20	..	..	..	0 12 2 16	..	..	..
21	..	..	..	0 13 1 6	..	..	0 5 3 1
22	..	..	0 11 1 18	..	..	..	0 15 3
23	..	..	1 19 1 6	..	..	..	..
24	..	..	2 8 0 18	..	..	..	..
26	..	..	1 14 2 6	..	..	..	..
27	..	0 17 3 12	0 11 1 9	..	..	..	..
28	..	..	0 10 2 0	..	..	0 17 0 9	..
29	..	0 1 2 7	0 9 3 18	..	0 4 3 6	..	0 17 2 2
30	..	..	0 10 1 25	..	..	..	1 2 2 1
31	..	..	1 0 0 21	..	0 12 2 10	..	1 15 3 1
Monthly Total	..	0 19 1 19	9 15 3 9	8 7 3 6	0 17 1 16	1 14 0 5	11 13 2
	1st Crop.	1st Crop. (*cont.*)	1st Crop. (*cont.*)	1st Crop. (*cont.*)	1st Crop. (*cont.*)	1st Crop. (*cont.*)	1st Crop (*cont.*)
June 2	..	..	0 10 3 9	..	0 6 3 23	..	0 14 1
3	..	..	0 9 0 23	..	0 6 1 16	..	0 14 2
4	..	..	0 10 1 4	..	0 4 2 26	..	0 7 3
5	..	..	0 9 0 25	..	..	..	0 11 0 1
6	..	..	..	0 9 3 22	0 4 2 26	0 9 1 1	[14 1 0 2
7	..	..	..	0 15 3 13	0 10 1 23	1 10 3 4	Total 1st Crop
9	..	..	..	0 8 1 2	0 6 1 23	0 14 0 21	
10	..	..	..	0 11 0 6	0 6 0 3	0 19 2 17	
11	..	..	..	0 8 2 27	0 7 0 12	1 2 1 16	..
12	..	..	..	0 10 0 8	0 6 1 19	0 12 1 7	..
13	..	..	..	0 10 0 17	0 5 1 4	0 14 0 27	..
14	..	..	..	0 14 2 6	0 10 3 18	0 16 2 23	..
16	..	..	..	0 9 0 13	0 7 0 12	0 13 2 5	..
17	..	..	..	0 8 3 6	0 5 1 25	0 13 0 4	..
18	..	..	..	0 8 3 7	0 5 0 14	0 14 1 6	..
19	..	..	2 0 0 14	[14 3 0 21]	0 4 2 26	0 15 1 21	..
20	..	..	0 9 3 4	Total 1st Crop.	0 5 0 12	0 13 2 14	..
21	..	1 5 3 18	0 19 2 11		0 12 0 9	1 5 0 7	..
23	..	0 12 3 9	0 7 0 20		0 5 2 3	0 13 0 4	..
24	..	1 0 2 22	[15 12 0 7]	..	0 4 1 3	0 13 0 2	..
25	..	0 8 2 24	Total 1st Crop.	..	0 4 2 21	0 12 1 23	..
26	..	0 19 1 15		..	0 5 0 26	0 14 0 25	..
27	..	..		..	0 4 2 27	0 12 3 1	..
28	0 5 2 13	0 14 0 23	..	..	0 11 0 4	[16 14 0 8]	..
30	0 2 3 13	0 8 1 11	..	..	..	Total 1st Crop.	..
Monthly Total	*0 8 1 26*	5 10 0 10	5 16 0 26	5 15 1 15	7 10 2 11	15 0 0 3	2 7 2 2

* *Area of Plot 1, five-acre field* = 0·80756 acre, and of Plot 1, ten-acre field = 0·79275 acre; for *sewaged plots, see preceding* Tables I. and II. of sewage applied.

Table III.—*continued.*

Detailed Record of the Amounts of Green Produce obtained in the Experiments on Permanent Grass Land.

Second Season 1862.

Green Grass obtained (calculated per acre). Each cell gives tons, cwts., qrs., lbs.

Dates of Cuttings.	Five-acre Field. Without Sewage. Plot 1.	Five-acre Field. With Sewage. Plot 2.	Five-acre Field. With Sewage. Plot 3.	Five-acre Field. With Sewage. Plot 4.	Ten-acre Field. Without Sewage. Plot 1.	Ten-acre Field. With Sewage. Plot 2.	Ten-acre Field. With Sewage. Plot 3.	Ten-acre Field. With Sewage. Plot 4.
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
	1st Crop. (*cont.*)	1st Crop. (*cont.*)		2d Crop.	1st Crop. (*cont.*)	2d Crop.	2d Crop.	2d Crop. (*cont.*)
July 1	0 2 1 10	0 9 0 22	..	..	0 5 3 6	..	..	0 12 3 3
2	0 2 2 9	0 8 0 3	..	..	..	..	..	0 18 0 0
3	0 2 0 26	0 8 1 19	..	..	0 3 0 17	..	..	0 15 2 0
4	..	0 3 2 8	..	..	0 3 1 24	..	..	0 7 1 20
5	0 5 1 16	0 15 2 8	..	..	0 8 3 11	..	..	1 10 3 25
7	0 2 2 17	0 9 0 5	..	..	0 4 0 25	..	..	0 16 2 11
8	0 2 2 9	0 4 2 7	..	0 0 3 8	0 6 1 16	..	..	0 16 3 22
9	0 2 3 11	0 7 1 12	..	..	0 5 2 6	..	..	0 18 2 10
10	0 2 1 0	0 7 2 11	..	..	..	..	..	0 16 0 0
11	0 2 2 19	0 7 1 11	..	..	0 3 2 17	..	..	0 16 1 12
12	0 5 3 18	0 17 2 23	..	..	0 6 3 27	..	1 7 1 19	0 7 0 11
14	0 2 3 5	0 8 1 18	..	..	0 8 1 19	..	0 12 2 11	[10 11 2 9] Total 2d Crop.
15	0 2 1 12	0 8 1 14	..	..	[10 19 1 27] Total 1st Crop.	..	0 14 2 26	
16	0 2 1 10	0 7 1 25	..	..		..	0 18 3 1	
17	0 2 1 8	0 7 0 12	..	..		..	0 14 1 26	..
18	0 2 2 8	0 8 3 0	..	..		..	0 16 2 7	..
19	0 4 2 15	0 12 0 23	..	..	..	0 3 3 21	1 5 1 0	..
21	0 2 1 0	0 6 0 12	..	..	..	..	[6 9 3 6] Total 2d Crop.	..
22	0 2 1 13	0 5 3 22	..	..	..	..		..
23	0 2 0 25	[14 12 1 4] Total 1st Crop.	..	0 8 1 5	..	..		..
24	0 2 2 12		..	0 8 2 4	..	0 4 3 3	..	..
25	0 2 1 3		..	0 10 0 6	..	..	..	..
26	0 4 2 16		..	0 15 1 14	..	..	..	..
28	0 2 1 17	..	..	0 9 0 17	..	..	..	..
29	0 1 3 22	..	..	0 8 2 24	..	..	..	..
30	0 1 3 17	..	..	1 1 0 17	..	..	..	..
31	0 5 0 6	..	..	0 17 1 8	..	..	..	..
Monthly Total	3 16 0 23	3 2 3 3	..	4 19 1 19	2 11 2 0	0 3 2 24	6 9 3 6	3 16 1 2
	1st Crop. (*cont.*)	2d Crop.	2d Crop.	2d Crop. (*cont.*)	2d Crop.	2d Crop. (*cont.*)		3d Crop.
Aug. 1	0 4 3 20	..	..	0 18 2 1	..	..	..	..
2	0 10 0 12	..	0 9 3 0	1 2 0 23	..	..	..	..
4	0 1 2 20	.	0 9 0 5	[7 0 0 15] Total 2d Crop.	..	..	..	..
5	0 1 2 19	..	0 9 1 8		..	..	..	..
6	0 2 1 0	..	0 11 0 14		..	..	..	..
7	0 2 0 1	..	0 12 3 8		..	..	..	..
8	0 2 0 21	..	0 9 3 20	..	..	..	..	..
9	0 4 1 13	..	0 19 3 9	..	..	..	..	..
11	0 1 3 27	..	0 9 2 9	..	..	..	..	..
12	0 1 2 9	..	0 9 3 3	..	..	..	..	..
13	0 1 2 20	..	0 9 2 15	..	..	..	..	..
14	0 2 3 11	..	0 12 1 24	..	..	..	..	..
15	0 1 3 16	..	0 9 1 1	..	..	..	..	..
16	0 2 2 26	..	0 18 1 4	..	..	..	..	..
18	0 2 1 12	..	0 12 1 11	..	..	..	..	..
19	0 1 3 16	..	0 10 1 1	..	..	0 16 0 22	..	..
20	0 1 2 19	..	0 10 0 19	..	..	0 10 1 0	..	..
21	[6 13 1 3] Total 1st Crop.	..	0 8 2 14	..	..	0 15 3 1	..	..
22		0 10 1 4	[9 12 0 25] Total 2d Crop.	..	..	0 18 1 11	..	..
23		0 19 0 27		..	..	1 17 2 24	..	..
25	..	0 8 1 25		..	..	0 13 1 5	..	..
26	..	0 9 2 20		..	..	0 17 2 10	..	..
27	..	0 10 1 9	..	..	..	0 3 0 14	..	0 10 3 13
28	..	0 9 2 14	..	..	0 3 1 19	[7 0 3 27] Total 2d Crop.	..	0 18 1 21
29	..	0 9 0 13	..	..	0 3 1 24		..	0 15 0 7
30	..	*0 19 3 16*	..	..	0 4 3 13		..	0 11 1 23
Monthly Total	*2 8 2 10*	*4 16 2 16*	9 12 0 25	2 0 2 24	0 11 3 0	6 12 1 3	..	2 15 3 8

Table I.—*continued.*

Detailed Record of the Sewage applied to Permanent Grass Land. Second Season 1861-2.

Dates.	Five-acre Field. Average Time taken to fill Gauge-tank (3·216 tons).	Five-acre Field. Time of application.	Five-acre Field. Sewage applied (calculated per acre). Plot 2. (Area ·99875 acre.)	Plot 3. (Area ·93061 acre.)	Plot 4. (Area 1·00512 acre.)	Ten-acre Field. Average Time taken to fill Gauge-tank (3·216 tons).	Ten-acre Field. Time of application.	Ten-acre Field. Sewage applied (calculated per acre). Plot 2. (Area ·9875 acre.)	Plot 3. (Area ·99533 acre.)	Pl[ot 4.] (A[rea] 1·6[…] ac[re.])
	Mins.	H. M.	Tons.	Tons.	Tons.	Mins.	H. M.	Tons.	Tons.	T[ons.]
Jan. 1	15·00	3 30	46·31	..	..	..	..	..	..	
6	15·16	9 45	..	..	123·47	..	..	..	..	
7	15·16	9 45	..	133·52	..	12·00	4 45	77·35	..	
„	..	..	..	..	..	12·00	5 0	..	..	[illegible]
8	15·00	5 45	74·43	..	..	..	..	..	..	
„	15·34	4 0	..	..	50·06	..	..	..	..	
13	14·50	9 45	..	..	129·09	..	..	..	..	
14	14·57	9 45	..	137·78	..	12·00	5 0	..	80·73	
„	..	..	..	..	..	12·34	5 0	..	..	[illegible]
15	14·34	6 0	81·34	..	..	..	..	..	..	
„	15·34	4 0	..	..	50·06	..	..	..	..	
21	21·25	5 45	..	56·09	..	..	..	..	..	
22	16·34	5 0	59·43	..	..	..	..	..	..	
„	16·00	5 0	..	..	59·99	..	..	..	..	
27	15·83	9 45	..	..	113·24	..	..	..	..	
28	15·50	9 45	..	130·40	..	12·34	5 0	..	78·51	
„	..	..	..	..	..	12·50	5 0	..	..	[illegible]
29	15·50	5 0	68·64	..	..	..	..	..	..	
„	14·67	4 0	..	..	58·34	..	..	..	..	
Total -	(15·41)	103 30	323·04	407·59	566·25	(12·30)	29 45	77·35	159·24	[illegible]
Feb. 3	22·16	11 15	..	..	97·46	..	..	..	..	
4	15·67	11 30	..	153·14	..	11·67	7 45	139·77	..	
„	..	..	..	..	..	12·50	3 45	..	..	[illegible]
5	16·34	11 15	..	..	132·17	..	..	..	..	
10	16·50	10 45	..	..	134·32	..	..	..	..	
11	16·16	11 30	..	147·53	..	11·50	5 45	..	96·68	
„	..	..	..	..	..	12·34	5 45	..	..	[illegible]
12	18·00	11 30	..	..	123·65	..	..	..	..	
17	16·54	4 45	..	..	55·81	..	..	..	..	
18	16·83	11 30	..	141·65	..	12·34	5 45	..	96·23	
„	..	..	..	..	..	12·00	[illegible]	..	..	[illegible]
19	16·67	11 45	136·86	..	..	..	..	..	..	
24	16·54	11 15	..	..	138·17	..	..	..	..	
25	17·83	11 30	..	133·71	..	11·50	[illegible]	97·70	..	
„	..	..	..	..	..	12·34	5 45	..	..	[illegible]
26	18·00	3 0	82·36	..	..	..	..	..	..	
„	16·00	7 15	..	..	88·99	..	..	..	..	
Total -	(17·08)	128 45	169·22	575·02	751·57	(11·98)	[illegible]	237·47	187·16	[illegible]
Mar. 3	16·00	11 15	..	..	134·98	..	..	..	..	
4	18·00	11 30	..	133·44	..	12·00	5 45	..	93·54	
„	..	..	..	..	..	11·34	5 45	..	..	[illegible]
5	16·34	4 45	80·21	..	..	..	..	..	..	
„	17·34	3 45	..	..	41·33	..	..	..	..	
17	(6 tanks*)	11 0	..	..	25·60	..	..	..	..	
21	16·00	11 30	..	149·00	..	12·00	5 45	..	93·34	
„	..	..	..	..	..	11·33	5 45	..	..	[illegible]
22	14·50	4 15	56·91	..	..	..	..	..	..	
„	15·67	5 45	..	..	80·75	..	..	..	..	
24	..	..	..	..	..	12·00	4 45	..	..	[illegible]
25	..	..	..	..	..	11·83	11 30	..	188·25	
26	..	..	..	..	..	12·00	6 45	109·91	..	
„	..	..	..	..	..	11·67	4 15	..	..	[illegible]
27	14·67	11 0	..	..	148·98	..	..	..	..	
28	13·67	11 30	..	174·40	..	..	..	..	..	
29	13·33	6 45	93·53	..	..	..	..	..	..	
„	14·00	3 45	..	..	51·42	..	..	..	..	
31	..	..	..	..	..	12·16	11 30	..	..	[illegible]
Total -	(16·73)	98 45	235·44	455·84	478·29	(11·85)	61 45	109·91	374·03	[illegible]

* When the number *of tanks* is given, the flow was too slow and irregular to estimate it by average time taken to fill the gauge-tank, and therefore the actual number of tankfuls *counted.*

Table IV.

ed Record of the Amounts of Green Produce obtained in the Experiments on Permanent Grass Land.

Third Season 1863.

Green Grass obtained (calculated per acre).							
Five-acre Field.				Ten-acre Field.			
Without Sewage.	With Sewage.			Without Sewage.	With Sewage.		
Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 1.	Plot 2.	Plot 3.	Plot 4.
tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
			1st Crop.				1st Crop.
..	..	..	..	..	..	..	0 10 1 0
..	..	..	..	..	..	..	0 14 3 0
..	..	..	..	..	..	..	0 15 1 0
..	..	..	0 14 2 20	..	..	..	..
..	..	..	..	..	..	..	0 16 1 0
..	..	..	0 17 1 18	..	..	..	..
..	..	..	0 18 3 17	..	..	..	..
..	..	..	1 5 3 13	..	..	..	..
..	..	..	..	..	..	..	0 18 1 0
..	..	..	3 16 3 12	..	..	..	3 14 3 0
	1st Crop.	1st Crop.	1st Crop.			1st Crop.	1st Crop.
..	..	..	0 12 1 21	..	..	..	..
..	..	..	2 1 0 5	..	..	..	..
..	..	..	0 15 2 19	..	..	..	..
..	..	..	0 12 2 20	..	..	..	..
..	..	..	0 14 2 20	..	..	..	..
..	..	..	..	..	..	..	0 15 3 0
..	..	..	..	..	..	..	2 0 3 27
..	..	0 16 0 13	1 3 2 14	..	..	..	..
..	..	2 9 0 16	[9 16 3 27]	..	..	..	..
..	..	1 10 3 15	Total	..	..	..	..
..	..	1 15 3 26	1st Crop.	..	..	..	..
..	..	..	..	..	..	0 19 1 9	0 16 2 0
..	..	..	..	..	..	1 4 3 11	0 14 2 0
..	..	..	..	..	..	1 12 2 14	[8 2 1 27]
..	..	1 15 2 24	..	..	..	..	Total
..	..	1 13 0 4	..	..	..	..	1st Crop.
..	..	1 11 1 19	..	..	..	..	..
..	..	..	..	..	..	1 13 0 15	..
..	..	..	..	..	..	1 14 3 15	..
..	..	..	..	..	..	1 15 1 16	..
..	0 11 3 8	0 12 2 13	..	..	..	..	..
..	0 16 2 11	[12 4 3 18]	..	..	..	..	..
.	0 12 1 14	Total	..	..	..	..	..
..	0 11 1 1	1st Crop.	..	..	..	..	..
..	0 11 2 1	..	..	..	..	..	..
..	1 5 3 18	..	..	..	..	..	..
..	4 9 1 25	12 4 3 18	6 0 0 15	..	..	[illegible]	[illegible]

Table IV.—*continued.*

Detailed Record of the Amounts of Green Produce obtained in the Experimen[ts] on Permanent Grass Land.

Third Season 1863.

Dates of Cuttings.	Green Grass obtained (calculated per acre).							
	Five-acre Field.				Ten-acre Field.			
	Without Sewage.	With Sewage.			Without Sewage.	With Sewage.		
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 1.	Plot 2.	Plot 3.	Plot 4
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs.
		1st Crop. (*cont.*)	2d Crop.	2d Crop.	1st Crop.	1st Crop.	1st Crop. (*cont.*)	2d Cro[p.]
June 1	..	0 11 3 22	..	..	..	..	..	..
2	..	0 10 0 14	..	..	..	..	..	..
3	..	1 10 1 21	..	..	..	..	..	..
4	..	..	..	..	..	..	1 13 0 8	..
5	..	..	..	..	..	..	0 18 0 23	..
6	..	..	..	..	..	1 10 3 14	0 17 2 8	..
8	..	..	..	..	..	1 11 2 3	[12 9 0 7]	..
9	..	..	..	..	..	1 10 3 1		..
10	..	..	..	..	..	1 13 1 24	Total	..
11	..	..	..	..	..	1 12 2 5	1st Crop.	..
12	..	..	..	..	..	1 12 2 17	..	..
13	..	..	..	..	..	1 19 2 13	..	..
15	..	0 13 2 18	..	..	..	..	..	..
16	..	1 8 3 5	..	..	..	..	..	..
17	..	1 9 3 7	..	..	..	..	..	..
18	..	[10 14 1 0]	..	..	..	1 10 2 1	..	..
19	..	Total	..	..	..	[13 1 3 22]	..	1 15 0
20	..	1st Crop.	..	2 5 3 18	..		..	..
22	..	..	..	1 11 1 11	..	Total	..	..
23	..	..	0 16 2 7	..	..	1st Crop.	..	..
24	..	..	0 14 3 10	..	0 4 0 11	..	2d Crop.	7 6 0
25	..	..	..	4 6 3 0	0 5 2 3	..	0 12 1 19	2 12 1
26	..	..	..	2 9 1 27	0 5 3 25	..	0 9 1 6	[11 13 2
27	..	..	..	[10 18 2 0]	0 6 3 1	..	1 5 2 14	Total
29	..	..	0 18 3 6		1 5 3 0	..	..	2d Cro[p.]
30	..	..	0 19 1 25	Total 2d Crop.	0 19 3 13	..	..	..
Monthly Total	..	6 4 2 3	3 9 2 20	10 18 2 0	3 7 3 25	13 1 3 22	5 16 0 22	11 13 2
	1st Crop.	2d Crop.	2d Crop. (*cont.*)		1st Crop. (*cont.*)	2d Crop.	2d Crop. (*cont.*)	2d Cro[p.]
July 1	..	..	1 0 3 0	..	0 14 0 22	..	..	..
2	..	..	..	..	0 7 3 15	..	0 12 0 20	..
3	..	..	..	..	0 8 0 7	..	0 15 3 19	..
4	..	..	..	..	0 12 0 11	..	1 6 0 3	..
6	..	..	0 16 1 0	..	..	..	..	..
7	..	..	0 17 3 20	..	..	..	..	..
8	..	..	1 0 0 9	..	0 6 1 24	..	..	..
9	2 6 0 6	..	..	..	0 4 1 26	..	1 0 0 17	..
10	..	..	..	..	0 6 3 6	..	1 0 3 10	..
11	0 4 0 23	..	1 7 1 12	..	[6 7 3 24]	..	[7 2 1 24]	..
13	0 3 0 23	..	0 15 0 17	..		..		..
14	0 4 0 13	0 10 0 19	[9 7 0 22]	..	Total	..	Total	..
15	0 3 0 1	0 13 1 11		..	1st Crop.	..	2d Crop.	..
16	..	0 16 1 11	Total	..	..	..	..	..
17	..	1 0 0 0	2d Crop.	..	..	..	..	..
18	0 9 1 4	1 8 0 27	..	..	..	..	..	..
20	0 3 2 17	1 4 2 23	..	..	..	..	..	..
22	..	..	..	..	..	0 6 3 10	..	..
23	..	..	..	..	..	0 15 0 3	..	..
24	..	..	..	..	..	0 13 3 20	..	..
25	..	..	..	..	..	1 9 2 13	..	..
27	0 5 1 11	0 15 0 2	..	..	..	..	..	..
28	[3 18 3 14]	[6 7 3 9]	..	..	..	0 18 2 26	..	..
29	Total	Total	..	..	..	1 1 2 2	..	..
30	1st Crop.	2d Crop.	..	..	..	0 7 1 16	..	..
31	..	..	..	..	..	[5 13 0 6]	..	0 9
						Total 2d Crop.		

Table IV.—*continued.*

Record of the Amounts of Green Produce obtained in the Experiments on Permanent Grass Land.

Third Season 1863.

Green Grass obtained (calculated per acre).

Five-acre Field.				Ten-acre Field.			
Without Sewage.	With Sewage.			Without Sewage.	With Sewage.		
Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 1.	Plot 2.	Plot 3.	Plot 4.
tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
		3d Crop.	3d Crop.			3d Crop.	3d Crop. (*cont.*)
..	..	..	1 11 1 3	..	..	..	..
..	..	..	0 18 0 18	..	..	..	..
..	..	..	0 14 3 26	..	..	..	..
..	..	..	0 19 2 3	..	..	..	..
..	..	..	0 19 0 3	..	..	..	..
..	..	..	..	..	..	..	0 15 2 0
..	..	1 12 3 10	..	..	..	..	..
..	..	1 3 2 15	..	..	..	..	..
..	..	..	..	..	..	..	0 15 0 0
..	..	..	..	..	..	..	0 14 0 0
..	..	..	0 16 2 5	..	..	..	..
..	..	..	0 19 0 3	..	..	..	..
..	..	1 6 1 8	[6 18 2 5]	..	..	..	..
..	..	..		..	..	..	0 15 1 0
..	..	..	Total	..	..	..	0 15 2 0
..	..	..	3d Crop.	..	..	..	0 16 1 0
..	..	..	..	..	..	..	0 16 1 14
..	..	..	..	..	..	..	0 16 3 0
..	..	..	..	..	..	..	1 12 0 0
..	..	..	..	..	..	0 14 3 7	[8 6 1 26]
..	..	..	..	..	..	0 12 3 6	
..	..	..	..	..	..	0 15 3 7	Total
..	..	..	..	..	..	1 0 1 9	3d Crop.
..	..	..	..	..	..	0 15 3 7	..
..	..	..	4th Crop.	..	..	1 15 0 20	..
..	..	..	0 17 1 11	..	..	..	..
..	..	4 2 3 5	7 15 3 16	..	..	5 14 3 0	7 18 2 14
2d Crop.	3d Crop.	3d Crop. (*cont.*)	4th Crop. (*cont.*)	2d Crop.	3d Crop.	3d Crop. (*cont.*)	4th Crop.
..	..	..	0 18 2 3	..	..	..	..
..	..	..	..	..	..	..	0 12 3 0
..	..	0 15 1 7	..	..	..	..	..
..	..	1 8 1 17	..	..	..	..	..
..	..	..	..	..	..	1 5 1 12	..
..	..	0 16 1 0	..	..	..	[7 0 0 12]	..
..	..	[7 2 3 1]	1 8 0 11	..	..	Total	..
..	..		1 1 3 8	..	..	3d Crop.	..
..	..	Total	..	..	0 18 0 11	..	..
..	..	3d Crop.	..	..	1 1 0 1	..	..
..	1 0 3 15	..	..	..	..	..	..
..	0 14 0 10	..	..	..	..	..	..
..	..	..	0 14 1 27	..	..	..	..
..	0 12 2 2	..	..	..	..	..	..
..	..	..	..	..	0 17 3 11	..	..
..	..	..	..	0 11 3 9	1 4 2 6	..	..
..	..	..	0 14 2 13	..	..	..	..
0 5 2 8	..	..	0 17 0 11	..	..	..	..
0 3 2 24	..	..	1 1 1 23	..	..	..	..
0 10 2 23	..	..	0 17 3 18	..	..	..	..
[0 19 3 27]	..	..	[8 11 1 13]	..	0 17 3 13	..	..
	..			1 1 0 14	1 1 3 16	..	..
Total	..	4th Crop.	Total			..	..
2d Crop.	..	1 2 0 25	4th Crop.	[1 12 3 23]	[6 1 0 2]	..	..
..	..	1 11 0 17	..	Total	Total	..	..
..	..	0 18 3 13	..	2d Crop.	3d Crop.	..	..
0 19 3 27	2 7 1 27	6 12 0 23	7 14 0 2	1 12 3 23	6 1 0 2	1 5 1 12	0 12 3 0

Table IV.—*continued.*

Detailed Record of the Amounts of Green Produce obtained in the Experi on Permanent Grass Land.

Third Season 1863.

Dates of Cuttings.	Green Grass obtained (calculated per acre). Five-acre Field. Without Sewage.	Five-acre Field. With Sewage.			Ten-acre Field. Without Sewage.	Ten-acre Field. With Sewage.		
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 1.	Plot 2.	Plot 3.	Pl
	tons. cwts. qrs. lbs.	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts*
		3d Crop. (*cont.*)	4th Crop. (*cont.*)	5th Crop.			4th Crop.	4th (*co*
Oct. 1	..	..	..	..	..	..	..	1 10
2	..	..	..	..	..	..	..	0 19
3	..	..	..	..	..	..	..	1 10
5	..	..	1 12 1 5	..	..	..	..	
6	..	..	..	..	..	..	..	0 17
7	.	..	..	..	..	..	0 9 0 20	0 14
8	..	..	..	..	..	..	1 4 0 25	[6 5
9	..	..	..	..	..	..	1 16 2 3	T
10	..	0 15 3 11	..	..	..	..	[3 9 3 20]	4th
13	..	0 19 2 14	..	..	..	..	Total 4th Crop.	
14	..	[4 2 3 24]	0 13 2 0	..	..	..	..	
19	..	Total 3d Crop.	[5 18 0 4]	0 14 1 20	..	..	..	
		4th Crop.	Total 4th Crop.	Total 5th Crop.				
20	..	0 9 0 13	..	..	..	..	..	
21	..	0 7 3 5	..	..	..	..	..	
		[0 16 3 18] Total 4th Crop.						
Monthly Total	..	2 12 1 15	2 5 3 5	0 14 1 20	..	..	3 9 3 20	5 12
		5th Crop.	5th Crop.	6th Crop.		4th Crop.	5th Crop.	5th
Nov. 27	..	0 3 0 16	0 5 2 10	0 5 2 24	..	..	..	
28	..	Total 5th Crop.	Total 5th Crop.	Total 6th Crop.	..	0 9 1 6	0 10 0 5	0 11
						Total 4th Crop.	Total 5th Crop.	T 5th
Monthly Total	..	0 3 0 16	0 5 2 10	0 5 2 24	..	0 9 1 6	0 10 0 5	0 11

Table V.

Detailed Record of the Sewage applied, and of the Amounts of Green Produce obtained in Experiments on Italian Rye-grass.

Season 1863.

Dates.	Average time* taken to fill Gauge-tank (3·308 tons).	Time of application.	Sewage applied (calculated per acre). Plot 2. (Area 0·999 acre.)	Sewage applied (calculated per acre). Plot 3. (Area 0·99831 acre.)	Green Grass obtained (calculated per acre). Without Sewage. Plot 1. (Area 1·00484 acre.)	Green Grass obtained. With Sewage. Plot 2. (Area 0·999 acre.)	Green Grass obtained. With Sewage. Plot 3. (Area 0·99831 acre.)
	Mins.	H. M.	Tons.	Tons.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
					1st Crop.	1st Crop.	1st Crop.
April 24	..	..	..	..	..	0 17 0 2	1 10 2 6
25	..	..	..	..	..	1 12 0 17	0 16 0 3
27	..	..	..	..	..	0 14 1 1	1 9 1 6
28	..	..	..	..	1 3 2 16	1 0 0 2	[3 15 3 15]
29	91·67	12 0	..	20·03	1 5 2 21	[4 3 1 22]	Total 1st Crop.
30	101·67	11 15	..	22·00	0 15 0 12	Total 1st Crop.	
Monthly Total	(96·24)	23 15	..	48·03	3 4 1 21	4 3 1 22	3 15 3 15
May 1	120·00	12 0	19·87	..	0 11 0 22	..	..
2	107·50	11 30	..	21·27	0 12 0 21	..	..
4	137·50	5 0	..	7·23	0 14 1 8	..	..
5	133·33	12 0	..	17·89	[5 2 0 16]	..	..
6	120·00	11 30	19·04	..		..	..
7	117·50	11 30	..	19·46	Total	..	..
8	122·50	11 15	..	18·26	1st Crop.	..	..
9	120·00	11 0	18·21	..	..	..	..
11	123·33	12 0	..	19·35	..	..	..
12	137·50	10 0	..	14·46	..	..	..
13	88·75	11 30	25·75	..	..	..	..
14	112·50	12 0	..	21·21	..	..	..
18	75·00	4 30	..	11·93	..	..	..
19	72·50	12 0	32·89	..	..	..	..
20	69·00	12 0	..	34·58	..	..	2d Crop.
27	67·50	4 30	..	13·25	..	..	0 7 1 21
28	65·60	12 0	36·34	..	..	..	0 2 3 22
29	71·25	10 45	..	30·00	..	..	0 7 3 18
30	72·60	10 30	..	28·76	..	..	0 13 0 2
Monthly Total	(95·80)	197 30	152·10	257·65	1 17 2 23	..	1 11 1 7
June 1	88·75	10 15	22·95	..	..	..	0 7 2 1
2	78·75	12 0	..	30·30	..	..	0 7 1 15
3	101·67	8 45	..	17·11	..	..	0 7 2 13
4	95·00	10 30	21·96	..	..	..	0 11 1 2
5	90·00	12 0	..	26·51	..	..	0 5 0 3
6	90·00	11 0	..	24·30	..	..	0 14 0 3
8	97·50	9 15	..	18·86	..	..	0 10 0 2
9	130·00	11 0	..	16·83	..	..	0 6 0 21
10	85·00	10 15	..	23·97	..	2d Crop.	0 6 3 9
11	76·00	12 0	..	31·39	..	0 5 1 0	0 6 3 11
12	87·50	12 0	..	27·27	..	0 7 2 25	[5 14 0 3]
13	73·73	11 0	..	29·65	..	0 17 0 2	
15	116·67	8 30	14·48	..	..	1 4 2 6	Total
16	102·50	11 15	..	21·82	..	0 12 0 25	2d Crop.
17	96·25	8 45	..	18·07	..	0 6 1 1	..
18	93·75	12 0	25·43	..	..	0 8 1 21	..
19	86·25	12 0	..	27·66	..	0 10 1 21	..
20	85·00	9 0	..	21·05	..	0 14 3 2	..
22	86·25	8 45	20·16	..	2d Crop.	1 2 3 3	..
23	83·33	7 0	16·69	..	0 17 3 18	0 8 2 8	3d Crop.
24	(6·00 tanks)	12 0	..	19·88	0 15 0 20	0 3 1 25	0 3 1 1
25	(6·00 „)	..	19·87	..	1 1 3 16	[7 1 1 27]	0 5 0 16
26	(5·75 „)	..	19·04	..	1 0 3 17		0 9 1 2
27	(5·25 „)	..	17·38	..	1 11 3 11	Total	0 11 2 16
29	..	..	..	..	2 6 2 3	2d Crop.	0 10 1 13
30	..	..	..	..	1 3 3 1	..	0 7 1 25
					[8 18 0 2]		
					Total 2d Crop.		
Monthly Total	..	..	177·96	354·66	8 18 0 2	7 1 1 27	6 9 3 13

* When the number of tanks is given, the flow was too slow and irregular to estimate it by the average time taken to fill the gauge-tank, and therefore the actual number of tankfuls was stated.

TABLE V.—*continued.*

Detailed Record of the Sewage applied, and of the Amounts of Green Produce obtained in Experiments on Italian Rye-grass.

Season 1863.

Dates.	Average Time* taken to fill Gauge-tank (3·306 tons).	Time of application.	Sewage applied (calculated per acre). Plot 2. (Area 0·999 acre.)	Plot 3. (Area 0·99831 acre.)	Green Grass obtained (calculated per acre). Without Sewage. Plot 1. (Area 1·00484 acre.)	With Sewage. Plot 2. (Area 0·999 acre.)	Plot 3. (Area 0·99831 acre.)
	Mins.	H. M.	Tons.	Tons.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
							3d Crop.
July 1	(3·28tanks)	..	10·76	..	..	..	0 6 1 1
2	(5·75 „)	..	19·04	..	..	..	0 11 0 18
3	(5·00 „)	..	..	16·57	..	..	0 7 0 1
4	(3·00 „)	..	9·93	..	..	..	0 14 0 3
6	(1·50 „)	..	..	4·97	..	..	0 9 1 2
„	30·50	2 0	..	13·04			
7	(4·75tanks)	..	15·73	..	..	..	0 14 1 3
„	31·50	2 0	12·68	..			
8	(2·75tanks)	..	..	9·11	..	..	0 5 3 1
„	26·50	2 0	..	15·01			
9	(6·00tanks)	..	19·87	..	..	..	0 7 3 1
10	(4·73 „)	..	..	15·67	..	..	0 8 0 12
11	(6·30 „)	..	..	20·88	..	..	0 15 2 10
13	(2·52 „)	..	..	8·35	..	3d Crop. 0 10 0 11	7 7 1 13
„	24·50	2 0	..	16·23			Total 3d Crop.
14	(3·00tanks)	..	..	9·94	..	0 8 2 1	
„	23·50	2 0	..	10·98			
15	(5·16tanks)	..	..	17·10	..	0 7 0 13	..
„	24·50	2 0	..	16·23			
16	(6·75tanks)	..	..	22·37	..	0 7 0 6	..
„	24·60	2 0	..	16·57			
17	(4·93tanks)	..	..	16·34	..	0 10 0 27	..
„	24·50	2 0	..	16·23			
18	(6·00tanks)	..	..	19·88	..	0 13 0 1	..
20	(3·00 „)	..	..	9·94	..	0 6 3 9	..
„	23 50	2 0	..	16·92			
21	(4·00tanks)	..	13·25	..	..	0 7 0 15	..
„	25·50	2 0	15·58	..			
22	(3·75tanks)	..	12·42	..	..	0 10 2 1	..
„	25·50	2 0	15·58	..			
23	(7·00tanks)	..	..	23·20	..	0 5 2 26	..
„	29·50	2 0	..	13·48			
24	(6·83tanks)	..	22·62	..	..	0 7 0 17	..
„	32·50	2 0	12·23	..			
25	(2·30tanks)	..	..	7·62	..	0 13 3 23	..
„	28·00	2 0	..	14·20			
27	(3·55tanks)	..	..	11·76	..	0 7 3 7	..
„	29·50	2 0	..	13·48			
28	(1·00tank)	..	3·31	..	..	0 2 3 6	4th Crop. 0 6 0 15
„	32·50	2 0	12·23	..			
29	(0·93tanks)	..	..	3·08	..	5 16 3 21	0 7 2 1
30	(6·93 „)	..	22·95	..	..	Total 3d Crop.	0 9 1 3
31	(5·43 „)	..	..	17·99	..		0 7 2 1
Monthly Total	..	..	213·12	405·14	..	5 16 3 21	6 10 2 22

* When the number of tanks is given, the flow was too slow and irregular to estimate the the average time taken to fill the ...

Table V.—*continued.*

Detailed Record of the Sewage applied, and of the Amounts of Green Produce obtained in Experiments on Italian Rye-grass.

Season 1863.

Dates.	Average time * taken to fill Gauge-tank (3·368 tons).	Time of application.	Sewage applied (calculated per acre). Plot 2. (Area 0·999 acre.)	Plot 3. (Area 0·99631 acre.)	Green Grass obtained (calculated per acre). Without Sewage. Plot 1. (Area 1·00464 acre.)	With Sewage. Plot 2. (Area 0·999 acre.)	Plot 3. (Area 0·99631 acre.)
		H. M.	Tons.	Tons.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
					3rd Crop.		
August 1	(4·03tnks.)	..	13·25	..	0 5 3 2	..	0 8 3 2
3	(0·88 „)	..	..	2·75	0 6 0 5	..	0 5 0 3
4	(4·00 „)	..	13·25	..	0 5 0 4	..	0 9 0 4
5	(3·00 „)	..	..	9·94	0 1 1 21	..	0 5 2 23
6	(5·65 „)	..	18·71	..	0 4 2 11	..	0 6 2 23
7	(3·48 „)	..	..	11·53	0 3 2 26	..	0 5 3 1
8	(4 41 „)	..	..	14·61	0 7 1 24	4th Crop.	0 9 3 26
10	(3·88 „)	..	9·54	..	0 3 3 0	0 5 3 15	0 1 2 0
11	(3·20 „)	..	10·60	..	0 2 3 4	0 4 1 16	[[illegible]] Total 4th Crop.
12	(1·00 „)	..	..	3·81	[2 0 1 13] Total 3d Crop.	0 2 0 19	
13	(2·63 „)	..	..	8·66		..	
14	(3·60 „)	..	8·61	..		..	..
15	(3·25 „)	..	..	10·77		..	..
17	(3·30 „)	..	7·66	..	..	..	..
19	(1·00 „)	..	..	3·31	..	..	..
20	(5·64 „)	..	..	18·60	..	..	..
21	(3·40 „)	..	11·26	..	..	..	..
22	(3·80 „)	..	..	10·93	..	..	..
24	(3·16 „)	..	10·43	..	..	0 2 2 20	..
25	(1·55 „)	..	..	5·14	..	0 6 2 21	..
26	(3·56 „)	..	..	11·60	..	0 4 3 0	..
27	(5·46 „)	..	..	18·09	..	0 6 3 21	..
28	(5·40 „)	..	..	17·83	..	0 1 3 20	..
29	(4·81 „)	..	..	15·94	..	[1 14 1 18] Total 4th Crop.	5th Crop.
31	(5·30 „)	..	17·55	..	..		0 8 1 12
Monthly Total	.	..	120·82	163·53	2 0 1 13	1 14 1 13	3 0 2 10
Sept. 1	(5·11tnks.)	..	..	16·93	..	..	0 4 0 17
2	(4·45 „)	..	..	14·75	..	..	0 4 3 1
3	(3·45 „)	..	11·42	..	..	..	0 5 0 21
4	(5·34 „)	..	..	17·70	..	..	0 5 3 11
5	(3·81 „)	..	..	12·63	..	5th Crop.	0 9 1 7
7	(4·40 „)	..	14·57	..	..	0 1 3 4	0 2 3 10
8	(2·96 „)	..	..	9·49	4th Crop.	0 1 2 24	[2 0 1 23] Total 5th Crop.
9	(2·93 „)	..	..	9·61	0 2 1 19	..	
10	(5·61 „)	..	..	16·59	0 4 0 5	..	
11	(2·31 „)	..	..	7·65	0 3 0 6	..	
12	(2·46 „)	..	8·15	..	[0 9 2 7] Total 4th Crop.	..	..
15	(4·40 „)	..	..	14·58		..	..
16	(1·86 „)	..	..	6·16		..	..
17	(2·73 „)	..	9·04	..		..	..
18	(3·60 „)	..	..	11·93	..	..	..
19	(1·50 „)	..	4·97	..	..	..	..
21	(3·96 „)	..	..	13·19	..	..	..
22	(3·33 „)	..	..	11·08	..	0 4 2 14	..
23	(1·60 „)	..	5·30	..	..	0 4 2 10	..
24	(3·45 „)	..	..	11·45	..	0 0 2 10	..
25	(4·00 „)	..	..	13·25	..	[0 13 1 6] Total 5th Crop.	..
26	(2·00 „)	..	6·69	..	..		..
28	(4·44 „)	..	..	14·71	..		..
29	(3·00 „)	..	..	9·94	..		..
30	(1·90 „)	..	..	6·30	..	..	..
Monthly Total	..	..	60·07	219·86	0 9 2 7	0 13 1 6	1 12 0 11

* *When the number of tanks is given*, the flow was too slow and irregular to estimate it by the *average time taken to fill the gauge-tank*, and therefor the actual number of tankfuls was [illegible].

TABLE V.—*continued.*

Detailed Record of the Sewage applied, and of the Amounts of Gree Produce obtained in Experiments on Italian Rye-grass.

Season 1863.

DATES.	Average time* taken to fill Gauge-tank (3·308 tons).	Time of application.	Sewage applied (calculated per acre). Plot 2. (Area 0·999 acre.)	Plot 3. (Area 0·99831 acre.)	Green Grass obtained (calculated per acre). Without Sewage. Plot 1. (Area 1·00484 acre.)	With Sewage. Plot 2. (Area 0·999 acre.)	Plot 3. (Area 0·99831 acre.)
		H. M.	Tons.	Tons.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs.
Oct. 1	(7·28tnks.)	..	24·11	..	..	..	..
2	(2·50 „)	..	..	8·28	..	..	..
3	(3·80 „)	..	12·58	..	..	..	..
5	(4·32 „)	..	..	14·32	..	..	.
6	(3·55 „)	..	..	11·76	..	..	..
7	(1·87 „)	..	6·19	..	..	..	..
8	(5·37 „)	..	..	17·79	..	..	..
9	(7·16 „)	..	..	23·73	..	..	..
10	(4·60 „)	..	15·23	..	..	..	..
15	..	..	..	..	..	..	6th Crop. 0 17 2
16	..	..	..	..	..	..	0 11 0
17	..	..	..	..	..	6th Crop. 0 12 2 1	0 14 2
21	..	..	..	..	..	0 13 1 15	[2 3 0 1 Total 6th Crop
23	..	..	..	..	5th Crop. 0 6 0 9 Total 5th Crop.	[1 5 3 16] Total 6th Crop.	
Monthly Total	..	..	58·11	75·88	0 6 0 9	5 3 16	2 3 0 1

* When the *number of tanks* is given, the flow was too slow and irregular to estimate it by t average time taken to fill the gauge-tank, and therefore the actual number of tankfuls w counted.

TABLE VI.

DETAILED RECORD of FOOD consumed, and INCREASE yielded, by OXEN fed on UNSEWAGED and SEWAGED MEADOW GRASS, with OILCAKE in addition.

SEASON 1862.

28 days, from May 8 to June 5.

Dates of weighing.	Two Oxen on Unsewaged Grass. Particulars of the Food consumed. Grass. From: Field.	Plot.*	Crop.	Quantities (weighed green). tons.	cwts.	qrs.	lbs.	Oil-cake.† lbs.	Eight Oxen on Sewaged Grass. Particulars of the Food consumed. Grass. From: Field.	Plot.	Crop.	Quantities (weighed green). tons.	cwts.	qrs.	lbs.	Oil-cake.† lbs.
1862. May 8	Five-acre	00	1	0	1	2	11	6	Five-acre	4	1	0	8	0	15	24
9	,,	00	1	0	2	0	11	6	,,	4	1	0	8	2	14	24
10	,,	4	1	0	2	0	17	6	,,	4	1	0	9	2	9	24
11	,,	4	1	0	2	0	17	6	,,	4	1	0	9	2	9	24
12	,,	4	1	0	2	0	14	6	,,	4	1	0	11	1	11	24
13	,,	4	1	0	2	0	24	6	,,	4	1	0	9	3	0	24
14	,,	4	1	0	2	1	6	6	,,	4	1	0	9	3	23	24
15	,,	4	1	0	2	1	17	6	,,	4	1	0	10	1	6	24
16	,,	00	1	0	2	0	14	6	,,	4	1	0	11	2	1	24
17	,,	4	1	0	2	0	12	6	,,	4	1	0	10	2	21	24
18	,,	4	1	0	2	0	11	6	,,	4	1	0	10	2	21	24
19	,,	4	1	0	2	0	24	6	,,	4	1	0	12	0	27	24
20	,,	4	1	0	2	1	11	6	,,	4	1	0	10	1	8	24
21	,,	4	1	0	2	1	22	6	,,	4	1	0	10	3	15	24
22	,,	00	1	0	2	2	6	6	,,	3	1	0	9	3	6	24
23	,,	00	1	0	2	0	14	6	,,	3	1	0	9	0	7	24
24	,,	00	1	0	2	0	11	6	,,	3	1	0	10	3	10	24
25	,,	3	1	0	2	0	14	6	,,	3	1	0	10	3	9	24
26	,,	3	1	0	2	0	27	6	,,	3	1	0	11	1	15	24
27	,,	00	1	0	2	3	16	6	,,	3	1	0	10	2	1	24
28	,,	00	1	0	2	3	6	6	,,	3	1	0	9	2	26	24
29	,,	0	1	0	2	0	4	6	,,	3	1	0	8	2	13	24
30	,,	0	1	0	2	1	0	6	,,	3	1	0	9	0	23	24
31	,,	0	1	0	2	0	18	6	,,	3	1	0	8	3	22	24
June 1	,,	0	1	0	2	0	20	6	,,	3	1	0	8	3	22	24
2	,,	0	1	0	2	1	13	6	,,	3	1	0	9	3	1	24
3	,,	0	1	0	2	2	16	6	,,	3	1	0	8	0	14	24
4	,,	0	1	0	2	1	1	6	,,	3	1	0	9	0	7	24
Total in 28 days				3	3	0	15	168	Total in 28 days			13	18	1	19	672
Average per head per day				0	1	0	14	3	Average per head per day			0	1	0	27	3

WEIGHTS AND INCREASE OF THE OXEN, &c.

Nos.	Two Oxen: Weights.‡ May 8.	Weights.‡ June 5.	Increase in 28 days.	Per 1,000 lbs. live-weight per week. Food consumed. Grass.	Food consumed. Oilcake.	Increase in weight.	Eight Oxen: Weights. May 8.	Weights. June 5.	Increase in 28 days.	Per 1,000 lbs. live-weight per week. Food consumed. Grass.	Food consumed. Oilcake.	Increase in weight.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	1,129	1,234	105	745	17½	23·9	1,230	1,318	88	836	18	24·4
2	1,130	1,252	122				1,141	1,232	91			
3	..	..	..	..	..	..	1,073	1,186	113			
4	..	..	..	..	..	..	1,168	1,316	148			
5	..	..	..	..	..	..	1,136	1,252	116			
6	..	..	..	..	..	..	1,066	1,170	104			
7	..	..	..	..	..	..	1,050	1,152	102			
8	..	..	..	..	..	..	1,005	1,152	147			
Totals	2,259	2,486	227	..	..	..	8,869	9,778	909	..	..	..
Means	1,130	1,243	113	..	..	..	1,109	1,222	114	..	..	..

* Plot "0" is unmeasured land without sewage, and Plot "00" unmeasured land with sewage.
† Equal parts *linseed cake and rape cake.*
‡ *Until May 29th, the two oxen received* sewaged grass, the unsewaged not being ready for cuttin[g]
that *date, at which time the animals* weighed 1,225 lbs. and 1,256 lbs. respectively.

Table VI.—*continued.*

Detailed Record of Food consumed, and Increase yielded, by Oxen fed o Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Season 1862.

28 days, from June 5 to July 3.

Dates of weighing.	Two Oxen on Unsewaged Grass.								Eight Oxen on Sewaged Grass.							
	Particulars of the Food consumed.															
	Grass							Oil-cake.†	Grass							
	From			Quantities (weighed green).					From			Quantities (weighed green).				
	Field.	Plot.*	Crop.	tons.	cwts.	qrs.	lbs.	lbs.	Field.	Plot.*	Crop.	tons.	cwts.	qrs.	lbs.	
1862. June 5	Five-acre	0	1	0	2	0	2	6	Five-acre	3	1	0	7	3	25	
6	,,	0	1	0	1	3	6	6	,,	4	1	0	9	1	21	
7	,,	0	1	0	1	3	26	6	,,	4	1	0	7	3	0	
8	,,	0	1	0	2	0	0	6	,,	4	1	0	7	3	6	
9	,,	0	1	0	2	0	1	6	,,	4	1	0	7	3	22	
10	,,	0	1	0	2	0	20	6	,,	4	1	0	10	3	0	
11	,,	0	1	0	2	1	9	6	,,	4	1	0	8	1	13	
12	,,	0	1	0	2	1	12	6	,,	4	1	0	9	2	27	
13	,,	0	1	0	2	1	9	6	,,	4	1	0	9	3	3	
14	,,	0	1	0	1	3	11	6	,,	4	1	0	8	3	2	
15	,,	0	1	0	1	3	13	6	,,	4	1	0	8	3	4	
16	,,	0	1	0	2	2	7	6	,,	4	1	0	8	2	20	
17	,,	0	1	0	2	1	11	6	,,	4	1	0	8	1	25	
18	,,	0	1	0	2	1	1	6	,,	4	1	0	8	1	17	
19	,,	0	1	0	2	0	9	6	,,	3	1	0	7	3	23	
20	,,	0	1	0	2	0	23	6	,,	3	1	0	8	2	25	
21	,,	0	1	0	2	0	2	6	,,	3	1	0	7	1	27	
22	,,	0	1	0	2	0	4	6	,,	3	1	0	7	2	4	
23	,,	0	1	0	2	0	1	6	,,	3	1	0	5	3	12	
24	,,	0	1	0	2	0	2	6	,,	2	1	0	11	0	9	
25	,,	0	1	0	1	2	14	6	,,	2	1	0	8	0	5	
26	,,	0	1	0	1	3	9	6	,,	2	1	0	7	1	14	
27	,,	0	1	0	2	0	8	6	,,	00	1	0	6	3	13	
28	,,	1	1	0	2	0	1	6	,,	2	1	0	6	3	8	
29	,,	1	1	0	2	0	0	6	,,	2	1	0	6	3	14	
30	,,	1	1	0	2	1	5	6	,,	2	1	0	7	3	6	
July 1	,,	1	1	0	1	3	14	6	,,	2	1	0	8	2	4	
2	,,	1	1	0	1	3	24	6	,,	2	1	0	7	1	23	
Total in 28 Days	-	-		2	17	3	19	168	Total in 28 days	-	-	11	7	0	8	
Average per head per day			-	0	1	0	4	3	Average per head per day			0	1	0	2	

Weights and Increase of the Oxen, &c.

Nos.	Weights.		Increase in 28 days.	Per 1,000 lbs. live-weight per week.			Weights.		Increase in 28 days.	Per 1,000 lbs. live-w per week.		
	June 5.	July 3.		Food consumed.		Increase in weight.	June 5.	July 3.		Food consumed.		
				Grass.	Oilcake.					Grass.	Oilcake.	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
1	1,234	1,276	42	636	16¼	12·6	1,318	1,402	84	829	16¼	
2	1,262	1,338	66				1,232	1,330	98			
3	..	..	..	..	..	..	1,186	1,290	104			
4	..	..	..	..	..	..	1,316	1,390	74			
5	..	..	..	..	..	..	1,252	1,328	76			
6	..	..	..	..	..	..	1,170	1,220	50			
7	..	..	..	..	..	..	1,152	1,205	53			
8	..	..	..	..	..	..	1,152	1,256	104			
Totals	2,496	2,614	128	..	..	..	9,778	10,421	643	..	..	
Means	1,248	1,307	64	..	..	..	1,222	1,302	80	..	..	

* … unmeasured land without sewage, and Plot "00" unmeasured land with sewage.
† … linseed cake and rape cake.

TABLE VI.—*continued.*

Detailed Record of Food consumed, and Increase yielded, by Oxen fed on Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Season 1862.

28 days, from July 3 to July 31.

Dates of weighing.	Two Oxen on Unsewaged Grass.								Eight Oxen on Sewaged Grass.							
	Particulars of the Food consumed.															
	Grass.							Oil-cake.†	Grass.							Oil-cake.†
	From			Quantities (weighed green).					From			Quantities (weighed green).				
	Field.	Plot.*	Crop.	tons.	cwts.	qrs.	lbs.		Field.	Plot.*	Crop.	tons.	cwts.	qrs.	lbs.	
1862.								[illegible]								lbs.
July 3	Five-acre	1	1	0	1	3	4	6	Five-acre	2	1	0	7	2	15	24
4	"	0	1	0	1	3	9	6	"	00 & 2	1	0	8	0	18	24
5	"	1	1	0	2	0	18	6	"	2	1	0	7	1	6	24
6	"	1	1	0	2	0	20	6	"	2	1	0	7	1	13	24
7	"	1	1	0	2	0	13	6	"	2	1	0	8	0	21	24
8	"	1	1	0	2	0	8	6	"	00, 2 & 4	1 & 2	0	8	1	18	24
9	"	1	1	0	2	0	19	6	"	2	1	0	6	2	10	24
10	"	1	1	0	1	3	6	6	"	2	1	0	6	2	27	24
11	"	1	1	0	2	0	15	6	"	2	1	0	6	3	10	24
12	"	1	1	0	2	1	0	6	"	2	1	0	8	1	16	24
13	"	1	1	0	2	1	6	6	"	2	1	0	8	1	16	24
14	"	1	1	0	2	1	0	6	"	2	1	0	7	3	15	24
15	"	1	1	0	1	3	16	6	"	2	1	0	7	2	21	24
16	"	1	1	0	1	3	14	6	"	2	1	0	5	3	17	24
17	"	1	1	0	1	3	11	6	"	2	1	0	6	2	5	24
18	"	1	1	0	1	3	21	6	"	2	1	0	8	0	10	24
19	"	1	1	0	1	3	10	6	"	2	1	0	5	3	9	24
20	"	1	1	0	1	3	14	6	"	2	1	0	5	3	9	24
21	"	1	1	0	1	3	10	6	"	2	1	0	5	2	17	24
22	"	1	1	0	1	3	4	6	"	2	1	0	5	1	16	24
23	"	1	1	0	1	3	4	6	"	4	2	0	8	1	5	24
24	"	1	1	0	2	0	9	6	"	4	2	0	8	0	14	24
25	"	1	1	0	1	3	8	6	"	4	2	0	9	2	25	24
26	"	1	1	0	1	3	11	6	"	4	2	0	7	2	0	24
27	"	1	1	0	1	3	14	6	"	4	2	0	7	2	0	24
28	"	1	1	0	1	3	19	6	"	4	2	0	8	3	11	24
29	"	1	1	0	1	2	6	6	"	4	2	0	8	1	24	24
30	"	1	1	0	1	2	2	6	"	4	2	0	8	0	12	24
Total in 28 days - - - -				2	14	1	20	168	Total in 28 days - -			10	9	1	18	672
Average per head per day -				0	0	3	20	3	Average per head per day			0	0	3	21	3

WEIGHTS AND INCREASE OF THE OXEN, &c.

Nos.	Weights.		Increase in 28 days.	Per 1,000 lbs. live-weight per week.			Weights.		Increase (or loss) in 28 days.	Per 1,000 lbs. live-weight per week.		
				Food consumed.		Increase in weight.				Food consumed.		Increase in weight.
	July 3.	July 31		Grass.	Oilcake.		July 3.	July 31.		Grass.	Oilcake.	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	1,276	1,332	56	570	15½	11·0	1,402	1,426	24	556	16	5·6
2	1,338	1,400	62				1,330	1,328	− 2			
3	..	..	..	..	..	..	1,290	1,288	− 2			
4	..	..	..	..	..	..	1,390	1,448	58			
5	..	..	..	..	..	..	1,328	1,372	44			
6	..	..	..	..	..	..	1,220	1,266	46			
7	..	..	..	..	..	..	1,205	1,242	37			
8	..	..	..	..	..	..	1,256	1,286	30			
Totals	2,614	2,732	118	..	..	..	10,421	10,656	235	..	..	..
Means	1,307	1,366	59	..	..	..	1,303	1,332	29	..	..	..

* Plot "0" is unmeasured land without sewage, and Plot "00" unmeasured land with sewage.
† Equal parts linseed cake and rape cake.

TABLE VI.—*continued.*

Detailed Record of Food consumed, and Increase yielded, by Oxen fed on Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Season 1862.

28 days, from July 31 to August 28.

Dates of weighing.	Two Oxen on Unsewaged Grass. Particulars of the Food consumed. Grass. From: Field.	Plot.*	Crop.	Quantities (weighed green). tons.	cwts.	qrs.	lbs.	Oil-cake.†	Eight Oxen on Sewaged Grass. Grass. From: Field.	Plot.	Crop.	Quantities (weighed green). tons.	cwts.	qrs.	lbs.	Oil-cake.†
								lbs.								lbs.
July 31	Five-acre	1	1	0	1	1	20	6	Five-acre	4	2	0	6	2	3	24
Aug. 1	"	1	1	0	1	2	13	6	"	4	2	0	8	0	27	24
2	"	1	1	0	1	1	7	6	"	4	2	0	10	0	16	24
3	"	1	1	0	1	1	6	6	"	3	2	0	9	0	8	24
4	"	1	1	0	1	1	9	6	"	3	2	0	8	0	18	24
5	"	1	1	0	1	2	4	6	"	3	2	0	8	2	15	24
6	"	1	1	0	1	3	5	6	"	3	2	0	9	3	20	24
7	"	1	1	0	1	2	12	6	"	3	2	0	11	2	8	24
8	"	1	1	0	1	1	21	6	"	3	2	0	9	0	22	24
9	"	1	1	0	1	3	1	6	"	3	2	0	9	0	6	24
10	"	1	1	0	1	3	0	6	"	3	2	0	8	0	6	24
11	"	1	1	0	1	1	27	6	"	3	2	0	8	2	16	24
12	"	1	1	0	1	0	17	6	"	3	2	0	8	3	13	24
13	"	1	1	0	1	1	9	6	"	3	2	0	8	3	2	24
14	"	1	1	0	2	1	3	6	"	3	2	0	11	2	7	24
15	"	1	1	0	1	2	0	6	"	3	2	0	8	1	13	24
16	"	1	1	0	1	0	21	6	"	3	2	0	8	1	26	24
17	"	1	1	0	1	0	23	6	"	3	2	0	8	2	0	24
18	"	1	1	0	1	3	3	6	"	2	2	0	11	0	25	24
19	"	1	1	0	1	2	1	6	"	3	2	0	9	0	21	24
20	"	1	1	0	1	2	3	6	"	3	2	0	9	1	20	24
21	"	0	1	0	1	0	19	6	"	3	2	0	7	2	21	24
22	"	0	1	0	1	1	7	6	"	2	2	0	9	3	22	24
23	"	0	1	0	1	0	9	6	"	2	2	0	9	1	18	24
24	"	0	1	0	1	0	19	6	"	2	2	0	9	1	23	24
25	"	0	1	0	1	0	5	6	"	2	2	0	8	1	14	24
26	"	0	1	0	1	0	6	6	"	2	2	0	9	2	9	24
27	"	0	1	0	1	0	2	6	"	2	2	0	10	0	13	24
Total in 28 days		-	-	1	19	2	13	168	Total in 28 days	-	-	12	17	0	20	672
Average per head per day			-	0	0	2	23	3	Average per head per day			0	1	0	17	3

WEIGHTS AND INCREASE OF THE OXEN, &c.

Nos.	Two Oxen: Weights. July 31.	Aug. 28.	Increase in 28 days.	Per 1,000 lbs. live-weight per week. Food consumed. Grass.	Oilcake.	Increase in weight.	Eight Oxen: Weights. July 31.	Aug. 28.	Increase (or loss) in 28 days.	Per 1,000 lbs. live-weight per week. Food consumed. Grass.	Oilcake.	Increase (or loss) in weight.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	1,332	1,374	42	389	15	9·0	1,486	1,480	− 6	677	15¾	−1·1
2	1,400	1,458	58				1,328	1,272	−56			
3	..	..	..	..	..	..	1,288	1,290	2			
4	..	..	..	..	..	..	1,448	1,458	10			
5	..	..	..	..	..	..	1,372	1,386	14			
6	..	..	..	..	..	..	1,266	1,273	7			
7	..	..	..	..	..	..	1,242	1,240	− 2			
8	..	..	..	..	..	..	1,286	1,272	−14			
Totals	2,732	2,832	100	..	..	..	10,656	10,611	−45	..	..	..
Means	1,366	1,416	50	..	..	..	1,332	1,326	− 6	..	..	..

* *Plot "0" is unmeasured land without sewage.*

† Equal parts linseed cake and rape cake.

Table VI.—*continued.*

Record of Food consumed, and Increase yielded, by Oxen fed on nsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Season 1862.

28 days, from August 28 to September 25.

Particulars of the Food consumed.

Two Oxen on Unsewaged Grass.								Eight Oxen on Sewaged Grass.							
Grass. From Field.	Plot.*	Crop.	Quantities (weighed green). *tons.*	*cwts.*	*qrs.*	*lbs.*	Oilcake.† *lbs.*	Grass. From Field.	Plot.*	Crop.	Quantities (weighed green). *tons.*	*cwts.*	*qrs.*	*lbs.*	Oilcake.† *lbs.*
ive-acre	0	1	0	0	3	25	8	Five-acre	2	2	0	9	0	20	32
,,	0	1	0	1	0	8	8	,,	2	2	0	8	2	15	32
,,	0	2	0	1	3	3	8	,,	2	2	0	9	2	25	32
,,	0	2	0	1	3	5	8	,,	2	2	0	9	3	2	32
,,	0	2	0	1	3	3	8	,,	00 & 2	2	0	11	3	13	32
,,	0	2	0	1	3	8	8	,,	2	2	0	10	2	20	32
,,	0	2	0	1	3	13	8	,,	2	2	0	10	3	0	32
,,	0	2	0	1	3	16	8	,,	2	2	0	9	3	25	32
,,	0	2	0	1	3	15	8	,,	2	2	0	9	3	26	32
,,	0	2	0	1	3	8	8	,,	2	2	0	9	3	0	32
,,	0	2	0	1	3	10	8	,,	2	2	0	9	3	5	32
,,	0	2	0	1	3	1	8	,,	2	2	0	7	0	20	32
,,	0	2	0	1	3	12	8	,,	00	2	0	9	0	9	32
,,	0	2	0	1	3	15	8	,,	00	2	0	9	0	26	32
,,	0	2	0	1	3	17	8	,,	00 & 4	2 & 3	0	9	1	3	32
,,	0	2	0	1	3	16	8	,,	4	3	0	10	0	15	32
,,	0	2	0	1	3	2	8	,,	4	3	0	8	3	23	32
,,	0	2	0	1	3	1	8	,,	4	3	0	8	3	10	32
,,	0	2	0	1	2	23	8	,,	4	3	0	11	0	3	32
,,	0	2	0	1	2	20	8	,,	4	3	0	10	1	11	32
,,	0	2	0	1	2	15	8	,,	4	3	0	11	1	4	32
,,	0	2	0	1	3	3	10	,,	4	3	0	11	2	15	40
,,	0	2	0	1	2	13	10	,,	4	3	0	10	3	15	40
,,	0	2	0	1	3	3	10	,,	4	3	0	8	3	19	40
,,	0	2	0	1	3	6	10	,,	4	3	0	8	3	19	40
,,	0	2	0	1	3	7	10	,,	4	3	0	9	3	17	40
,,	0	2	0	1	3	16	10	,,	4	3	0	8	3	10	40
,,	0	2	0	1	2	21	10	,,	4	3	0	10	0	1	40
28 days	-	-	2	8	2	28	238	**Total in 28 days**	-	-	13	14	2	4	952
per head per day		-	0	0	3	13	4¼	**Average per head per day**			0	1	0	25	4¼

Weights and Increase of the Oxen, &c.

Weights.		Increase (or loss) in 28 days.	Per 1,000 lbs. live-weight per week.			Weights.		Increase in 28 days.	Per 1,000 lbs. live-weight per week.		
. 28.	Sep. 25.‡		Food consumed. Grass.	Food consumed. Oilcake.	Increase in weight.	Aug. 28.	Sep. 25.‡		Food consumed. Grass.	Food consumed. Oilcake.	Increase in weight.
lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*
,374	1,414	40	479	20¾	3·3	1,420	1,508	88			
,458	1,456	—2				1,272	1,425	153			
..	..	..	..	..	..	1,290	1,408	118			
..	..	..	..	..	..	1,458	1,524	66	790	21¾	16·7
..	..	..	..	..	..	1,386	1,468	82			
..	..	..	..	..	..	1,273	1,334	61			
..	..	..	..	..	..	1,240	1,310	70			
..	..	..	..	..	..	1,272	1,369	97			
,832	2,870	38	..	..	..	10,611	11,346	735	..	..	..
,416	1,435	19	..	..	..	1,326	1,418	92	..	..	..

" is unmeasured land without sewage, and Plot "00" unmeasured land with sewage.
cake only, *excepting* on August 28 and 29, on which days a mixture of linseed cake and rape
ve.
ghts *were in fact, for convenience,* taken on September 26, but in the calculations are supposed
ptember 25.

Table VI.—*continued.*

Detailed Record of Food consumed, and Increase yielded, by Oxen fed Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Season 1862.

18 days, from September 25 to October 13.

Dates of weighing.	Two Oxen on Unsewaged Grass. — Grass. From Field.	Plot.*	Crop.	Quantities (weighed green). tons.	cwts.	qrs.	lbs.	Oil-cake.† lbs.	Eight Oxen on Sewaged Grass. — Grass. From Field	Plot.*	Crop.	Quantities (weighed green). tons.	cwts.	qrs.	lbs.
1862. Sept. 25	Five-acre	0	2	0	1	3	24	12	Five-acre	4	3	0	11	1	2
26	,,	0	2	0	1	3	5	12	,,	4	3	0	9	3	3
27	,,	0	2	0	1	2	19	12	,,	4	3	0	8	3	21
28	,,	0	2	0	1	2	21	12	,,	4	3	0	8	3	26
29	,,	0	2	0	1	3	23	12	,,	4	3	0	10	1	6
30	,,	0	2	0	1	3	20	12	,,	4	3	0	10	0	1
Oct. 1	,,	0	2	0	1	3	23	12	,,	3	3	0	12	0	16
2	,,	0	2	0	2	0	6	12	,,	3	3	0	9	2	23
3	,,	0	2	0	1	3	3	12	,,	2 & 3	3	0	12	0	11
4	,,	1	2	0	1	3	17	12	,,	2	3	0	8	3	5
5	,,	1	2	0	1	3	20	12	,,	2	3	0	8	3	10
6	,,	1	2	0	1	3	11	12	,,	00 & 2	2 & 3	0	10	0	8
7	,,	1	2	0	1	3	8	12	,,	2	3	0	11	0	11
8	,,	1	2	0	1	3	9	12	,,	2	3	0	9	0	22
9	,,	1	2	0	1	3	9	12	,,	2	3	0	9	1	3
10	,,	1	2	0	1	3	24	12	,,	2	3	0	9	1	11
11	,,	1	2	0	1	3	6	12	,, ‡	2	3	0	7	2	16
12	,,	1	2	0	1	3	6	12	,, ‡	..	..	0	7	2	16
13	Five-acre	1	2	0	1	3	7	16	Five-acre‡	00	3	0	11	0	13
14	,,	1	2	0	1	3	14	16	,,	4	4	0	9	2	7
15	,,	1	2	0	1	3	8	16	,,	4	4	0	8	2	3
16	,,	1	2	0	1	3	11	16	,,	4	4	0	8	3	22
Total in 18 days (to Oct. 13) -				1	13	2	2	216	Total in 18 days (to Oct. 13)			8	16	0	16
Average per head per day -				0	0	3	20	6	Average per head per day			0	1	0	26

Weights and Increase of the Oxen, &c.

Nos.	Weights. Sept. 25. §	Oct. 13.	Increase (or loss) in 18 days.	Per 1,000 lbs. live-weight per week. Food consumed. [illegible]	Oilcake.	Increase (or loss) in weight.	Weights. Sept. 25. §	Oct. 13.	Increase (or loss) in 18 days.	Per 1,000 lbs. live-we[ight] per week. Food consumed. Grass.	Oilcake.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	1,414	1,356	−58	515	29¼	−10·5	1,508	1,488	−20	661	29¼
2	1,456	1,439	−17				1,425	1,378	−47		
3	..	..	..	..	..	..	1,408	1,414	6		
4	..	..	..	..	..	..	1,524	1,531	7		
5	..	..	..	..	..	..	1,468	1,448	−20		
6	..	..	..	..	..	..	1,334	1,332	− 2		
7	..	..	..	..	..	..	1,310	1,288	−22		
8	..	..	..	..	..	..	1,369	1,311	−58		
Totals	2,870	2,795	−75	..	..	..	11,346	11,184	−162	..	..
Means	1,435	1,397	−38	..	..	..	1,418	1,398	−20	..	..

* Plot "0" is unmeasured land without sewage, and plot "00" unmeasured land with sewage.
† Linseed cake.
‡ On October 11, 3 cwts. 0 qrs. 12 lbs., on October 12, the whole quantity, viz. 7 cwts. 2 qrs. 16 lbs., an[d] ... 3 cwts. 2 qrs. 26 lbs. of the grass came from another (not experimental) field.
[§ The] weights were in fact, for convenience, taken on September 26, but in the calculations apply to September 25.

TABLE VII.

SUMMARY of the WEIGHTS and INCREASE of the OXEN fed respectively on UNSEWAGED and SEWAGED MEADOW GRASS, with OILCAKE in addition.

SEASON 1862.

—	Weights.								Increase in Weight.					
									May 8 to Oct. 13 = 22½ weeks.‡			June 5 to Oct. 13 = 18½ weeks.§		
	May 8.*	May 29.*	June 5.	July 3.	July 31.	Aug. 28.	Sept. 25.†	Oct. 13.	Total.	Per head per week.	Per 1,000 lbs. live-weight per week.	Total.	Per head per week.	Per 1,000 lbs. live-weight per week.
TWO OXEN ON UNSEWAGED GRASS.														
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs.*	*lbs. ozs.*	*lbs. ozs.*
1	1,129	1,225	1,254	1,276	1,332	1,374	1,414	1,356	227	10 1	8 2	122	6 9	5 1
2	1,130	1,255	1,252	1,338	1,400	1,458	1,456	1,439	309	13 11	10 11	187	10 1	7 8
Totals - -	2,259	2,480	2,486	2,614	2,732	2,832	2,870	2,795	536	—	—	309	—	—
Averages -	1,130	1,240	1,243	1,307	1,366	1,416	1,435	1,398	268	11 14	9 6	155	8 5	6 5
EIGHT OXEN ON SEWAGED GRASS.														
1	1,230	—	1,318	1,402	1,496	1,480	1,508	1,488	258	11 7	8 7	170	9 2	6 8
2	1,141	—	1,263	1,330	1,328	1,278	1,425	1,378	237	10 8	6 6	146	7 14	6 0
3	1,075	—	1,186	1,290	1,288	1,290	1,408	1,414	341	15 2	12 2	228	12 4	9 7
4	1,168	—	1,316	1,390	1,448	1,458	1,534	1,531	363	16 1	11 14	215	11 9	6 2
5	1,136	—	1,252	1,328	1,372	1,386	1,468	1,442	306	13 9	10 8	190	10 4	7 10
6	1,068	—	1,170	1,320	1,266	1,273	1,334	1,333	266	11 13	9 13	163	8 12	7 0
7	1,060	—	1,159	1,205	1,242	1,340	1,310	1,298	238	10 9	9 0	136	7 6	6 0
8	1,005	—	1,152	1,256	1,286	1,272	1,309	1,311	306	13 9	11 11	159	8 9	6 15
Totals - -	8,869	—	9,778	10,421	10,656	10,611	11,346	11,194	2,515	—	—	1,406	—	—
Averages -	1,109	—	1,222	1,303	1,332	1,326	1,418	1,398	289	12 13	10 4	176	9 7	7 4

* Both lots of animals were weighed on May 8, but as the unsewaged grass was not ready to cut until May 29, the 2 animals were then re-weighed.
† Sept. 25 was the proper day of weighing, but as a matter of convenience, it did not, in fact, take place until Sept. 26.
‡ This period includes the first 3 weeks during which the 2 oxen, otherwise fed on unsewaged grass, received sewaged grass.
§ This period excludes the first month of the experiment during 3 weeks of which the 2 oxen, otherwise fed on unsewaged grass, received sewaged [redacted]

TABLE VIII.

SUMMARY of FOOD CONSUMED and INCREASE YIELDED by the OXEN fed on UNSEWAGED and SEWAGED MEADOW GRASS, with OILCAKE in addition.

SEASON 1862.

Periods.		Two Oxen on Unsewaged Grass.						Eight Oxen on Sewaged Grass.					
		Food consumed.				Increase (or Loss) in Weight.		Food consumed.				Increase (or Loss) in Weight.	
Dates.	Number of Weeks.	Per head per week.		Per 1,000 lbs. live-weight per week.		Per head per week.	Per 1000 lbs. live-weight per week.	Per head per week.		Per 1,000 lbs. live-weight per week.		Per head per week.	Per 1,000 lbs. live-weight per week.
		Grass.	Oilcake.	Grass.	Oilcake.			Grass.	Oilcake.	Grass.	Oilcake.		
		lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
May 3 to June 5 - -	4	864	21	745	17¾	28 6	23 15	974	21	836	16	28 6	24 6
June 5 to July 3 -	4	611	21	636	16¾	16 6	13 9	795	21	629	16¾	20 2	15 15
July 3 to July 31 - -	4	763	21	570	13¾	14 12	11 1	733	21	556	16	7 6	5 9
July 31 to Aug. 28 -	4	555	21	399	15	12 8	9 6	909	21	677	15¾	−1 6	−1 1
Aug. 28 to Sept 25 -	4	683	29¾	479	29¾	4 12	3 5	961	29¾	700	21¾	23 0	16 12
Sept. 25 to Oct. 13 -	2½	730	48	515	29¾	−14 9	−10 5	950	48	651	29¾	−7 14	−5 9
May 3 to Oct. 13 * -	22½	738	25	[illegible]	19¾	11 14	9 6	883	25	704	20	12 13	10 4
June 5 to Oct 13 † -	18½	706	25¾	535	19¼	6 5	6 5	863	25¾	658	19¾	9 7	7 4

* This period includes the first 3 weeks during which the 2 oxen, otherwise fed on unsewaged grass, received sewaged grass.
† This period excludes the first month of the experiment during 3 weeks of which the 2 oxen, otherwise fed on unsewaged grass, received sewaged grass.

DETAILED RECORD of FOOD consumed, and MILK yielded, by COWS fed on the UNSEWAGED [illegible]
SECOND SEASON, 1869; 7 days.—May 2 to May 8.

THREE COWS.—UNSEWAGED GRASS.

Food consumed (tons, cwts., qrs., lbs.)

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop. —	*	*	*	*	*	*	*	—	—
Grass: Quantities weighed	0 3 1 0	0 4 0 6	0 4 2 14	0 4 2 14	0 4 0 0	0 4 0 4	0 4 0 0	1 8 2 10	0 1 1 12
Oilcake (equal parts linseed and rape cake)	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 2 7	0 0 0 3

Yield of Milk, &c. (lbs., ozs.)

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 1). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. [illegible]	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Mar. 20	945	14 6	12 8	16 4	11 4	20 0	11 14	21 5	14 10	20 0	12 5	20 8	14 10	23 0	17 7	220 1	32 12
2	Cross Sht.-horn	7	Dec. 25	976	13 12	12 8	13 2	13 2	18 12	12 8	16 14	11 14	13 0	10 14	16 3	12 3	15 10	13 4	193 9	27 10
3	Cross Sht.-horn	Aged	Feb. 26	884	16 14	15 10	19 6	15 0	18 12	15 0	20 0	13 13	20 2	14 11	21 12	15 13	19 6	15 0	241 2	34 7
			Totals -	2,806	45 0	40 10	48 12	39 6	57 8	39 6	58 3	40 4	53 2	37 14	58 6	42 10	57 0	45 11	663 12	—
			Means -	935	15 0	13 9	16 4	13 2	19 3	13 2	19 6	13 7	17 11	12 10	19 7	14 3	19 0	15 [illegible]	221 4	31 10

TWELVE COWS.—SEWAGED GRASS.

Food consumed (tons, cwts., qrs., lbs.)

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop. —	Ten-acre, Plot 4, Crop 1.	Ten-acre, Plot 4, Crop 1.	Ten-acre, Plot 4, Crop 1.	Ten-acre, Plot 4, Crop 1.	Ten-acre, Plot 4, Crop 1.	Ten-acre, Plot 4, Crop 1.	Ten-acre, Plot 3, Crop 1.	—	—
Grass: Quantities weighed	0 13 1 23	0 13 3 23	0 10 3 23	0 11 0 0	0 17 1 23	0 17 2 23	0 16 0 14	4 19 2 17	0 1 0 21
Oilcake (equal parts linseed and rape cake)	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 2 1 0	0 0 0 3

Yield of Milk, &c. (lbs., ozs.)

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 1). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Nov. 18	1,143	12 8	8 2	12 8	10 0	13 0	10 0	13 6	10 1	13 1	9 8	13 14	10 8	13 10	13 0	165 2	23 9
2	Cross Sht.-horn	8	Feb. 2	1,158	12 8	10 10	13 2	10 10	18 2	10 10	15 10	11 1	13 1	11 0	14 15	9 8	15 12	11 0	179 7	25 10
3	Cross Sht.-horn	6	Dec. 1	1,076	14 6	8 12	13 12	11 4	15 0	9 6	13 2	0 13	13 6	10 8	14 4	10 4	13 8	11 10	168 15	24 2
4	Cross Sht.-horn	Aged	Jan. 28	906	16 14	11 14	16 4	13 2	18 2	11 4	16 14	11 9	17 0	13 10	15 15	11 12	16 10	12 9	202 7	28 15
5	Cross Sht.-horn	6	Nov. 17	1,070	13 12	13 2	13 12	11 4	16 14	11 14	12 8	11 3	13 0	11 10	14 13	9 4	13 0	11 4	177 3	25 6
6	Cross Sht.-horn	Aged	Jan 13	1,006	14 6	11 4	13 12	11 14	18 2	10 10	15 10	10 4	14 12	11 2	15 10	10 15	15 1	11 11	185 1	26 7
7	Cross Sht.-horn	8	Apr. 28	1,188	24 8	18 12	23 12	20 0	25 10	18 2	25 0	18 1	26 2	19 8	23 5	19 3	23 0	19 8	314 3	44 14
8	Cross Ayrshire	3	Apr. 13	723	15 10	10 0	15 10	12 8	16 14	9 6	15 0	8 14	13 14	9 6	15 1	0 6	13 14	10 13	176 6	25 3
9	Cross Sht.-horn	Aged	Feb. 16	965	13 12	9 6	13 12	10 6	18 2	8 12	16 4	9 14	14 14	10 5	14 3	9 14	14 10	11 0	174 12	24 15
10	Ayrshire -	6	Apr. 3	806	18 12	14 6	18 2	17 8	20 10	13 12	21 4	13 7	21 2	14 13	20 15	13 9	20 4	17 0	246 8	35 1
11	Guernsey -	4	Mar. 30	781	16 14	10 10	16 4	16 4	15 0	12 8	16 14	12 9	17 14	12 14	16 9	13 5	15 10	14 0	206 3	29 7
12	Cross Sht.-horn	7	Nov. 16	964	15 0	9 6	15 0	7 8	15 0	9 6	15 0	12 4	16 0	11 10	16 5	10 14	13 11	13 0	178 0	25 7
			Totals -	11,850	188 13	126 4	185 10	151 14	212 8	125 [illegible]	206 10	139 [illegible]	196 9	146 12	200 13	137 4	191 [illegible]	155 7	[illegible] 2	—

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—May 9 to May 15.

THREE COWS.—UNSEWAGED GRASS.

Food consumed.

	Friday.				Saturday.				Sunday.				Monday.				Tuesday.				Wednesday.				Thursday.				Total in 7 days.				Per head per day.			
Grass: From which Field, Plot, and Crop.	*				*				*				*				*				*				*				—				—			
	tons.	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*
Grass: Quantities weighed	0	3	1	4	0	5	0	0	0	4	2	10	0	4	2	9	0	5	0	14	0	5	0	14	0	2	0	0	1	9	2	23	0	1	1	18
Oilcake (equal parts linseed and rape cake)	0	0	0	9	0	0	0	9	0	0	0	9	0	0	0	9	0	0	0	9	0	0	0	9	0	0	0	9	0	0	3	7	0	0	0	3

Yield of Milk, &c.

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 15†) *lbs.*	Fri. A.M. *lbs.*	*ozs.*	Fri. P.M. *lbs.*	*ozs.*	Sat. A.M. *lbs.*	*ozs.*	Sat. P.M. *lbs.*	*ozs.*	Sun. A.M. *lbs.*	*ozs.*	Sun. P.M. *lbs.*	*ozs.*	Mon. A.M. *lbs.*	*ozs.*	Mon. P.M. *lbs.*	*ozs.*	Tues. A.M. *lbs.*	*ozs.*	Tues. P.M. *lbs.*	*ozs.*	Wed. A.M. *lbs.*	*ozs.*	Wed. P.M. *lbs.*	*ozs.*	Thurs. A.M. *lbs.*	*ozs.*	Thurs. P.M. *lbs.*	*ozs.*	Total in 7 days *lbs.*	*ozs.*	Per head per day *lbs.*	*ozs.*
1	Cross Sht.-horn	6	Mar. 20	966	22	7	13	5	21	10	13	3	19	15	13	0	21	4	12	7	19	0	12	15	19	7	15	11	20	6	11	13	236	7	33	12
2	Cross Sht.-horn	7	Dec. 25	1,004	13	1	12	0	14	6	11	4	14	1	10	8	14	6	11	10	14	7	11	12	13	0	12	15	16	4	10	6	179	15	25	11
3	Cross Sht.-horn	Aged	Feb. 26	896	19	8	15	8	20	9	14	0	22	0	13	0	20	8	12	9	20	8	11	11	21	10	15	11	20	12	12	5	239	10	34	4
	Totals			2,966	55	0	40	11	56	9	38	7	56	0	36	8	56	2	36	8	53	15	36	3	54	1	44	5	57	6	34	7	656	0	—	
	Means			965	18	5	13	10	18	14	12	13	18	11	12	3	18	11	12	1	17	16	12	9	18	0	14	13	19	2	11	8	218	11	31	4

TWELVE COWS.—SEWAGED GRASS.

Food consumed.

	Friday.				Saturday.				Sunday.				Monday.				Tuesday.				Wednesday.				Thursday.				Total in 7 days.				Per head per day.			
Grass: From which Field, Plot, and Crop.	Ten-acre, Plot 3, Crop 1.				Ten-acre, Plot 3, Crop 1.				Ten-acre, Plot 3, Crop 1.				Ten-acre, Plot 3, Crop 1.				Ten-acre, Plot 2, Crop 1.				Ten-acre, Plot 4, Crop 1.				Ten-acre, Plot 4, Crop 1.				—				—			
	tons.	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*	*tons.*	*cwts.*	*qrs.*	*lbs.*
Grass: Quantities weighed	0	13	1	23	1	0	1	23	0	19	1	1	0	19	1	1	0	16	2	24	1	0	3	9	1	1	1	8	6	10	3	27	0	1	3	7
Oilcake (equal parts linseed and rape cake)	0	0	1	8	0	0	1	8	0	0	1	8	0	0	1	8	0	0	1	8	0	0	1	8	0	0	1	8	0	2	1	0	0	0	0	3

Yield of Milk, &c.

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 1). *lbs.*	Fri. A.M. *lbs.*	*ozs.*	Fri. P.M. *lbs.*	*ozs.*	Sat. A.M. *lbs.*	*ozs.*	Sat. P.M. *lbs.*	*ozs.*	Sun. A.M. *lbs.*	*ozs.*	Sun. P.M. *lbs.*	*ozs.*	Mon. A.M. *lbs.*	*ozs.*	Mon. P.M. *lbs.*	*ozs.*	Tues. A.M. *lbs.*	*ozs.*	Tues. P.M. *lbs.*	*ozs.*	Wed. A.M. *lbs.*	*ozs.*	Wed. P.M. *lbs.*	*ozs.*	Thurs. A.M. *lbs.*	*ozs.*	Thurs. P.M. *lbs.*	*ozs.*	Total in 7 days *lbs.*	*ozs.*	Per head per day *lbs.*	*ozs.*
1	Cross Sht.-horn	6	Nov. 18	1,148	14	8	9	11	14	3	10	10	14	1	10	6	15	8	9	0	13	8	11	2	13	12	9	8	13	14	11	0	170	11	24	6
2	Cross Sht.-horn	5	Feb. 2	1,158	15	0	9	8	13	7	10	2	13	4	9	0	12	10	8	0	12	0	10	10	13	10	10	1	12	4	9	0	157	8	22	8
3	Cross Sht.-horn	6	Dec. 1	1,076	14	1	9	13	12	9	10	14	13	1	11	2	13	13	9	0	12	8	10	8	12	10	10	1	13	6	9	6	163	11	23	4
4	Cross Sht.-horn	Aged	Jan. 26	966	15	10	10	14	14	6	11	8	14	15	9	8	14	11	9	8	13	7	11	0	15	6	11	1	15	0	10	0	176	12	25	4
5	Cross Sht.-horn	6	Nov. 17	1,076	12	10	10	10	12	0	10	9	13	0	11	0	11	12	8	12	10	12	9	15	12	4	9	4	12	3	10	6	155	3	22	3
6	Cross Sht.-horn	Aged	Jan. 13	1,006	15	10	9	13	14	10	11	6	15	6	9	11	15	2	10	0	14	2	10	6	15	1	10	7	15	4	9	4	176	3	25	3
7	Cross Sht.-horn	8	Apr. 26	1,126	23	9	17	4	23	0	18	1	23	4	18	6	20	4	16	0	22	14	17	5	23	8	18	2	23	0	16	11	290	4	41	7
8	Cross Ayrshire	3	Apr. 13	723	14	4	8	15	14	2	9	4	14	1	9	7	13	10	9	0	13	5	9	13	13	14	9	4	13	0	9	0	161	2	23	0
9	Cross Sht.-horn	Aged	Feb. 16	965	14	0	10	5	14	6	9	9	14	2	9	2	14	4	8	4	13	14	10	6	13	8	11	12	12	8	9	4	164	4	23	7
10	Ayrshire	6	Apr. 3	866	21	2	14	4	20	8	14	5	20	8	14	6	20	4	12	12	19	0	15	4	20	13	14	11	20	7	13	15	240	8	34	10
11	Guernsey	4	Mar. 30	781	16	5	11	7	17	6	12	0	17	4	12	10	15	8	11	0	15	0	12	2	15	10	12	8	13	15	10	11	193	14	27	9
12	Cross Sht.-horn	7	Nov. 1[illegible]	[illegible]	14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

THREE COWS.—UNSEWAGED GRASS.

Food consumed.					Ten-acre, Plot 0,* Crop 1.		Ten-acre, Plot 0,* Crop 1.		Ten-acre, Plot 0,* Crop 1.		Ten-acre, Plot 0,* Crop 1.		Ten-acre, Plot 0,* Crop 1.		Ten-acre, Plot 0,* Crop 1.		Ten-acre, Plot 0,* Crop 1.		—	—
	Grass	From which Field, Plot, and Crop. —			tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
		Quantities weighed - - -			0 5 0 9¼		0 5 3 0¼		0 6 1 25¼		0 5 3 0		0 6 3 27¼		0 4 3 20¼		0 4 3 19¼		1 18 2 19	0 1 3 10
	Oilcake (equal parts linseed and rape cake) -				0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 2 7	0 0 0 3
Yield of Milk, &c. Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 15) lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	[illegible]	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Mar. 20	966	16 10	12 2	18 11	13 4	19 7	14 11	19 12	13 4	17 0	13 12	19 8	12 4	16 13	12 8	230 0	31 7
2	Cross Sht.-horn	7	Dec. 25	1,004	15 4	11 4	14 14	10 9	14 0	13 11	12 11	10 4	12 10	10 0	12 9	9 5	14 8	10 12	172 5	24 10
3	Cross Sht.-horn	Aged	Feb. 28	896	22 2	14 4	20 12	13 6	19 14	10 12	17 10	13 12	18 2	13 3	19 12	13 4	18 13	12 13	228 9	32 10
		Totals	-	2,866	54 0	37 10	54 5	37 5	53 5	39 2	50 1	37 4	48 2	36 15	51 13	34 13	50 2	36 1	630 14	—
		Means	-	955	18 0	[illegible] 9	18 2	12 7	17 12	13 1	16 11	12 7	16 1	12 5	17 4	11 9	16 11	12 0	206 15	29 0

TWELVE COWS.—SEWAGED GRASS.

Food consumed.					Ten-acre, Plot 4, Crop 1.		Ten-acre, Plot 4, Crop 1.		Ten-acre, Plot 3, Crop 1.		Ten-acre, Plot 3, Crop. 1.		Ten-acre, Plot 3, Crop 1.		Ten-acre, Plot 4, Crop 1.		Ten-acre, Plots 4, 3, & 00,* Crop 1.		—	—
	Grass	From which Field, Plot, and Crop. —			tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
		Quantities weighed - - -			0 13 1 23		0 15 3 21		0 15 3 23		0 15 0 15		0 14 1 23		0 15 3 23		0 10 3 6		5 10 0 22	0 1 1 7
	Oilcake (equal parts linseed and rape cake) -				0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 2 1 0	0 0 0 3
Yield of Milk, &c. Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 1) lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Nov. 18	1,143	13 10	9 6	13 11	11 0	13 4	11 8	13 2	9 5	12 0	10 2	14 0	8 14	13 14	9 15	163 8	23 6
2	Cross Sht.-horn	8	Feb. 2	1,138	12 6	10 4	13 14	10 12	13 10	11 6	13 13	9 3	12 4	10 0	15 4	8 15	13 2	9 10	163 6	23 5
3	Cross Sht.-horn	6	Dec. 1	1,076	11 0	10 4	14 0	9 11	11 14	11 0	13 14	9 9	11 10	10 3	13 13	9 11	13 0	9 11	159 3	22 12
4	Cross Sht.-horn	Aged	Jan. 26	906	14 8	9 12	14 7	11 11	15 2	12 0	14 13	8 10	13 6	10 9	15 3	10 6	14 6	10 2	175 4	25 1
5	Cross Sht.-horn	6	Nov. 17	1,076	10 6	9 9	12 13	11 8	12 6	12 2	12 8	8 10	11 0	11 13	12 0	8 11	12 2	10 2	156 10	22 4
6	Cross Sht.-horn	Aged	Jan. 13	1,006	13 6	10 4	14 7	9 15	14 12	12 2	14 0	10 8	13 6	10 15	11 1	9 5	14 6	10 4	168 15	24 2
†7	Cross Sht.-horn	8	Apr. 28	1,126	22 0	15 3	20 6	15 5	17 0	13 5	4 8	3 2	0 0	18 10	25 2	16 13	23 12	16 11	209 13	30 0
8	Cross Ayrshire	3	Apr 13	723	12 7	8 12	13 6	9 3	13 4	9 3	12 6	7 10	12 8	8 13	12 8	7 13	12 11	8 4	148 11	21 4
9	Cross Sht.-horn	Aged	Feb 16	965	13 4	10 11	14 6	9 15	12 12	11 11	14 7	8 7	13 6	9 14	13 10	9 15	14 0	10 3	165 8	23 13
10	Ayrshire -	6	Apr 3	866	19 10	13 8	20 14	13 15	20 7	14 5	20 7	11 6	17 10	14 7	19 4	14 0	20 0	13 6	233 2	33 5
11	Guernsey -	4	Mar 30	781	14 0	12 4	15 8	10 5	15 0	9 7	16 3	8 12	14 14	11 8	17 9	12 12	15 8	10 10	184 3	26 5
12	Cross Sht.-horn	7	Nov. 16	984	14 12	9 2	17 11	10 1	14 12	11 12	15 0	10 0	13 12	10 14	16 3	10 2	14 6	10 1	180 8	25 13
		Totals	-	11,850	175 5	128 14	184 6	131 5	174 3	139 11	164 15	105 2	145 14	137 12	183 12	127 5	181 5	126 14	2,109 11	—
		Means	-	986	14 10	10 12	15 6	10 15	14 8	11 10	13 12	8 12	12 9	11 8	15 5	10 10	15 2	10 12	175 12	25 2

* Unmanured land; designated Plot 0 when unsewaged, and Plot 00 when sewaged.

Table IX.—continued.

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—May 23 to May 29.

—					Friday.		Saturday.		Sunday.		Monday.		Tuesday.		Wednesday.		Thursday.		Total in 7 days.	Per head per day.
Three Cows.—Unsewaged Grass.																				
Food consumed. Grass	From which Field, Plot, and Crop.				Ten-acre, Plot 0,* Crop 1.		—		Ten-acre, Plot 0,* Crop 1.		Ten-acre, Plot 0,* Crop 1.		Ten-acre, Plot 0,* Crop 1.		Ten-acre, Plot 0,* Crop 1.		—		—	—
					tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
	Quantities weighed				0 7 2 15¼		..		0 4 0 15¼		0 4 0 18		0 6 1 3¾		0 7 1 15¼		..		1 9 2 10	0 1 1 18
Oilcake (equal parts linseed and rape-cake)					0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 2 7	0 0 0 3
Yield of Milk, &c. Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 29). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Mar. 20	1,042	17 10	13 13	19 11	10 8	18 10	13 6	17 7	12 9	17 3	14 13	17 3	14 5	18 2	13 4	218 5	31 3
2	Cross Sht.-horn	7	Dec. 25	1,054	15 2	10 8	12 9	8 12	12 7	11 13	12 8	10 15	11 4	12 5	12 13	12 2	12 13	11 4	167 3	23 14
3	Cross Sht.-horn	Aged	Feb. 26	948	20 0	13 6	19 7	12 2	19 4	13 6	19 6	13 2	18 2	15 14	19 3	14 12	17 5	17 0	232 3	33 5
	Totals			3,044	52 12	37 11	51 11	31 6	50 5	38 9	49 5	30 10	46 9	43 0	49 3	41 3	48 2	41 8	617 14	—
	Means			1,015	17 9	12 9	17 4	10 8	16 12	12 14	16 7	12 3	15 6	14 5	16 6	13 12	16 1	13 13	205 15	29 7
Twelve Cows.—Sewaged Grass.																				
Food consumed. Grass	From which Field, Plot, and Crop.				Ten-acre, Plot 3, Crop 1.		Five-acre, Plot 3, Crop 1		Five-acre, Plot 3, Crop 1.		Five-acre, Plot 3, Crop 1.		Five-acre, Plot 3, Crop 1.		Five-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		—	—
					tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
	Quantities weighed				0 15 2 23		1 7 2 0		0 10 0 23		0 10 0 24		0 18 0 10		0 17 0 5		0 16 3 9		5 15 2 16	0 1 1 14
Oilcake (equal parts linseed and rape-cake)					0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 2 1 0	0 0 0 3
Yield of Milk, &c. Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 29). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Nov. 18	1,178	13 0	9 4	12 6	9 2	11 2	10 9	11 8	9 14	12 4	10 11	13 6	10 10	13 6	10 14	158 0	22 9
2	Cross Sht.-horn	8	Feb. 2	1,308	12 7	10 5	13 8	10 4	11 12	11 5	12 3	9 8	12 8	10 10	13 4	9 6	13 12	9 0	158 7	22 10
3	Cross Sht.-horn	6	Dec. 1	1,153	12 11	10 0	13 4	10 1	11 14	9 6	12 4	9 13	11 8	9 6	12 8	9 12	12 5	10 6	165 2	23 3
4	Cross Sht.-horn	Aged	Jan. 26	972	13 8	9 15	13 6	10 11	13 6	9 0	12 14	10 3	13 10	11 3	14 0	10 12	13 10	10 10	167 2	23 14
5	Cross Sht.-horn	6	Nov. 17	1,107	13 10	10 3	13 0	9 6	12 12	11 6	11 0	9 13	13 1	11 11	13 2	10 8	13 0	10 13	160 6	22 15
6	Cross Sht.-horn	Aged	Jan. 13	1,096	14 6	10 5	14 13	10 7	13 6	9 14	15 1	9 0	13 2	10 10	14 4	11 1	14 2	10 6	171 3	24 7
†7	Cross Sht.-horn	6	May 2	1,008	23 4	16 13	23 8	16 14	21 0	17 6	21 4	16 0	21 1	17 5	23 0	18 2	23 4	15 12	272 9	38 16
8	Cross Ayrshire	5	Apr. 13	785	13 0	8 9	13 0	8 10	11 8	8 9	11 0	8 0	11 8	8 10	11 8	8 12	11 6	8 1	142 1	20 5
9	Cross Sht.-horn	Aged	Feb. 16	1,018	14 1	10 14	14 0	12 7	14 2	10 11	13 1	9 12	12 0	11 0	13 10	10 8	13 7	9 8	168 15	24 2
10	Ayrshire -	6	Apr. 3	900	20 0	14 10	20 0	14 6	18 12	14 4	18 2	13 13	18 0	13 4	19 8	14 2	19 6	15 0	235 15	33 11
11	Guernsey -	4	Mar 30	835	15 0	10 10	15 10	11 12	14 10	11 10	13 8	10 11	14 8	12 8	14 8	12 1	14 6	12 4	183 4	26 3
12	Cross Sht.-horn	7	Nov. 16	1,090	14 7	10 0	15 13	9 6	12 8	10 8	13 4	9 7	13 4	11 7	14 0	10 15	13 12	10 4	170 4	24 5

Three Cows.—Unsewaged Grass.

Food consumed (tons, cwts., qrs., lbs.)

	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Total in 7 days	Per day
Grass: From which Field, Plot, and Crop	Ten-acre, Plots 0* & 1, Crop 1	—	Ten-acre, Plot 1, Crop 1	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten acre, Plot 1, Crop 1.	—	—
Quantities weighed	0 5 1 10¼	— — — —	0 4 2 14	0 4 2 12½	0 5 1 1½	0 5 0 4½	0 5 2 10¼	1 8 2 6¼	0 1 1 12
Oilcake (equal parts linseed and rape cake)	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 0	0 0 0 9	0 0 2 7	0 0 0 3

Yield of Milk, &c. (lbs., ozs.)

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 29). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. P.M.	Total in 7 days	Per day
1	Cross Sht.-horn	6	Mar 29	1,042	19 0	13 2	19 12	13 11	17 10	11 8	17 10	14 1	10 6	13 7	16 8	12 8	13 0	12 5	213 1	30 7
2	Cross Sht.-horn	7	Dec. 25	1,054	12 7	11 1	10 8	11 11	13 0	10 4	11 8	13 4	12 8	11 0	10 4	12 12	10 8	11 6	161 1	23 0
3	Cross Sht.-horn	Aged	Feb. 20	948	17 1	17 1	20 2	12 0	17 14	12 8	17 11	14 0	17 4	12 2	18 0	12 13	17 8	11 12	218 14	31 4
			Totals -	3,044	48 8	41 4	50 6	37 15	48 8	34 4	47 0	40 5	40 2	36 9	43 2	38 1	43 9	35 7	593 0	—
			Means -	1,015	16 3	13 12	16 12	12 10	16 3	11 7	15 11	13 7	13 6	12 3	15 1	12 11	14 8	11 13	107 11	28 4

Twelve Cows.—Sewaged Grass

Food consumed (tons, cwts., qrs., lbs.)

	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Total in 7 days	Per day
Grass: From which Field, Plot, and Crop	Ten-acre, Plot 3, Crop 1.	Ten-acre, Plot 3, Crop 1	Ten-acre, Plot 3, Crop 1.	Ten-acre, Plot 3, Crop 1.	Ten-acre, Plot 3, Crop 1.	Ten-acre, Plot 3, Crop 1.	Ten-acre, Plot 3, Crop 1.	—	—
Quantities weighed	0 16 3 22	1 1 2 9	0 17 0 1	0 17 0 0	0 13 2 23	0 13 3 4	0 7 1 21	5 7 1 24	0 1 1 3
Oilcake (equal parts linseed and rape cake)	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 2 1 0	0 0 0 3

Yield of Milk, &c. (lbs., ozs.)

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 29). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. P.M.	Total in 7 days	Per day
1	Cross Sht.-horn	6	Nov. 19	1,178	13 1	10 3	12 14	9 5	12 2	9 8	12 10	11 16	12 6	9 8	11 12	9 4	11 12	9 4	165 8	22 3
2	Cross Sht.-horn	8	Feb. 2	1,203	12 2	9 4	11 4	9 10	12 14	9 0	11 14	11 7	11 12	9 6	12 0	9 2	12 2	9 3	161 0	21 9
3	Cross Sht.-horn	6	Dec. 1	1,153	11 13	9 5	12 6	9 0	11 12	9 7	11 0	11 1	11 0	8 13	11 0	9 0	11 4	8 12	147 1	21 0
4	Cross Sht.-horn	Aged	Jan. 20	972	11 2	10 6	13 10	9 7	12 4	10 0	12 4	11 8	13 7	9 4	11 6	8 3	11 6	8 1	156 6	22 5
5	Cross Sht.-horn	6	Nov 17	1,107	12 0	9 10	11 0	8 12	10 0	9 10	11 0	11 7	10 0	9 8	9 8	8 5	9 4	8 1	138 1	19 12
6	Cross Sht.-horn	Aged	Jan. 13	1,090	14 4	10 10	14 1	9 4	12 0	10 11	13 2	12 4	12 14	10 0	13 14	9 4	12 6	9 11	164 11	23 8
7	Cross Sht.-horn	9	May 2	1,068	20 8	10 2	22 0	15 2	20 6	15 4	20 6	15 2	20 7	16 12	20 8	14 3	20 2	14 8	250 6	35 12
8	Cross Ayrshire	5	Apr. 15	783	11 0	8 5	11 0	8 0	11 0	8 0	9 13	9 10	10 7	7 4	10 3	7 4	10 4	0 15	129 14	18 9
9	Cross Sht.-horn	Aged	Feb. 16	1,018	12 4	10 7	11 8	8 14	11 2	0 12	11 12	9 12	12 13	9 0	11 8	10 8	12 8	8 13	150 9	21 8
10	Ayrshire	6	Apr. 3	950	16 3	14 2	17 4	12 12	17 0	12 14	17 10	13 0	16 5	13 4	17 10	13 7	17 12	11 14	211 7	30 3
11	Guernsey	4	Mar. 30	835	15 0	10 9	16 7	10 15	12 2	11 9	13 8	12 11	13 8	9 3	13 2	10 7	13 6	10 12	171 9	24 8
12	Cross Sht.-horn	7	Nov 10	1,090	13 6	11 2	12 13	10 10	12 10	10 1	13 5	10 12	12 12	8 12	15 8	8 7	13 7	9 1	160 8	22 15
			Totals -	12,460	166 4	129 15	165 9	121 9	155 10	123 15	156 0	140 15	157 4	119 [illegible]	156 8	117 6	156 11	116 15	1,987 0	—
			Means -	1,038	13 14	10 13	13 13	10 2	12 15	10 8	13 3	11 12	13 2	9 15	13 1	9 12	13 15	9 12	165 9	22 11

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake addition.

Second Season 1862; 7 days.—June 6 to June 12.

THREE COWS.—UNSEWAGED GRASS.

Food consumed.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass, from which Field, Plot, and Crop.	—	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.		—
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass, Quantities weighed		0 3 2 12¼	0 4 0 15¼	0 4 0 14	0 4 3 6¾	0 4 3 0¼	0 5 0 18½	1 6 2 11½	0 1 1 2
Oilcake (equal parts linseed and rape cake)	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 2 7	0 0 0 3

Yield of Milk, &c.

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 29). lbs.	Friday A.M. lbs. ozs.	Friday P.M. lbs. ozs.	Saturday A.M.	Saturday P.M.	Sunday A.M.	Sunday P.M.	Monday A.M.	Monday P.M.	Tuesday A.M.	Tuesday P.M.	Wednesday A.M.	Wednesday P.M.	Thursday A.M.	Thursday P.M.	Total in 7 days lbs. ozs.	Per head per day lbs. ozs.
1	Cross Sht.-horn	6	Mar. 20	1,042	15 12	13 0	16 4	12 6	16 3	10 14	16 2	11 6	16 0	11 14	16 10	12 10	16 3	13 1	196 5	28 5
2	Cross Sht.-horn	7	Dec. 25	1,054	10 4	11 2	10 8	11 10	10 8	13 4	11 10	10 14	10 1	10 8	10 10	13 6	10 14	12 0	157 3	22 7
3	Cross Sht.-horn	Aged	Feb. 26	948	16 4	12 2	17 0	11 15	15 8	11 6	16 0	11 9	16 9	12 1	16 8	12 11	16 7	12 15	198 15	28 7
	Totals			3,044	42 4	36 4	43 12	35 15	42 3	35 8	43 12	33 13	42 10	34 7	43 12	38 11	43 8	38 0	554 7	—
	Means			1,015	14 1	12 2	14 9	12 0	14 1	11 13	14 9	11 4	14 3	11 8	14 9	12 15	14 8	12 11	184 13	26 6

TWELVE COWS. SEWAGED GRASS.

Food consumed.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass, from which Field, Plot, and Crop.	Ten-acre, Plot 3, Crop 1.	Ten-acre, Plots 00* and 2, Crop 1	Ten-acre, Plot 2, Crop 1.	Ten-acre, Plot 2, Crop 1	Ten-acre, Plot 2, Crop 1,	Ten-acre, Plot 2, Crop 1.	Ten-acre, Plot 2, Crop 1.	—	—
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass, Quantities weighed	0 10 2 4	0 15 2 8	0 14 2 16	0 14 2 17	0 13 0 11	0 18 3 9	1 1 0 23	5 8 2 4	0 1 1 5
Oilcake (equal parts linseed and rape cake)	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 3 1 0	0 0 0 3

Yield of Milk, &c.

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 29). lbs.	Friday A.M. lbs. ozs.	Friday P.M. lbs. ozs.	Saturday A.M.	Saturday P.M.	Sunday A.M.	Sunday P.M.	Monday A.M.	Monday P.M.	Tuesday A.M.	Tuesday P.M.	Wednesday A.M.	Wednesday P.M.	Thursday A.M.	Thursday P.M.	Total in 7 days lbs. ozs.	Per head per day lbs. ozs.
1	Cross Sht.-horn	6	Nov. 18	1,178	12 2	8 8	11 8	9 4	12 4	10 3	11 4	9 0	11 6	9 0	11 15	9 2	12 0	9 8	147 0	21 0
2	Cross Sht.-horn	8	Feb. 2	1,208	11 14	9 0	11 7	8 12	12 0	9 0	11 10	8 12	11 4	8 15	12 2	9 0	11 6	9 3	144 5	20 10
3	Cross Sht.-horn	6	Dec. 1	1,153	11 8	9 0	9 12	8 12	11 8	9 4	11 0	8 10	10 6	9 0	11 7	7 13	11 4	8 9	137 15	19 11
4	Cross Sht.-horn	Aged	Jan. 26	972	10 14	8 12	11 8	8 8	10 14	9 14	11 0	7 14	11 0	8 12	12 0	9 3	11 7	9 8	141 8	20 4
5	Cross Sht.-horn	6	Nov. 17	1,107	11 0	8 0	10 3	7 8	10 4	10 0	10 4	7 13	10 4	8 7	10 11	8 10	10 3	8 2	131 11	18 13
6	Cross Sht.-horn	Aged	Jan. 18	1,090	13 7	9 0	13 4	9 10	12 6	8 11	12 11	8 15	12 2	9 11	13 4	9 5	12 6	10 4	155 0	22 2
7	Cross Sht.-horn	6	May 2	1,098	20 11	14 6	20 4	15 0	10 8	15 11	10 3	14 11	10 0	15 4	20 12	15 5	20 0	15 11	245 6	35 1
8	Cross Ayrshire	3	Apl. 13	785	10 6	6 14	10 6	7 2	10 4	6 0	10 0	6 10	9 7	6 11	10 2	7 9	10 1	7 14	119 12	17 2
9	Cross Sht.-horn	Aged	Feb. 16	1,016	11 4	8 1	12 10	9 7	12 6	9 3	12 2	8 6	12 8	10 0	13 11	10 0	12 13	10 4	152 11	21 13
10	Ayrshire	6	Apl. 3	950	17 2	19 15	17 0	12 4	15 8	13 4	10 4	11 15	17 2	13 5	10 0	13 4	13 0	13 6	210 3	30 0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13 8	10 13	10 15	10 1	12 15	10 10	12 15	11 3	12 14	9 12	168 7	23 8

Three Cows.—Unsewaged Grass.

Cows' Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 29) lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
Food consumed. Grass. From which Field, Plot, and Crop.					Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		—	—
Quantities weighed (tons. cwts. qrs. lbs.)					0 4 3 8¼		0 3 3 21½		0 4 0 8½		0 4 0 6		0 5 1 18½		0 5 3 13½		0 3 3 3½		1 9 3 25	0 1 1 20
Oilcake (equal parts linseed and rape cake) (tons. cwts. qrs. lbs.)					0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 0 9		0 0 2 7	0 0 0 3
Yield of Milk, &c.					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Mar 20	1,042	16 5	11 11	16 1	11 8	15 8	11 4	15 7	11 6	15 4	12 2	16 0	11 2	15 15	10 6	189 15	27 2
2	Cross Sht.-horn	7	Dec. 25	1,054	10 2	11 7	10 6	12 13	11 0	10 6	9 10	11 8	10 4	11 0	10 1	9 4	10 11	11 13	150 7	21 8
3	Cross Sht.-horn	Aged	Feb. 26	948	16 0	12 1	15 6	12 0	16 0	11 15	15 9	11 8	17 6	11 1	16 8	12 5	16 2	11 7	196 4	27 14
			Totals -	3,044	42 7	35 3	42 1	36 5	42 8	33 9	40 10	34 6	42 14	34 3	42 9	32 9	43 12	33 10	535 10	—
			Means -	1,015	14 2	11 12	14 0	12 2	14 3	11 3	13 9	11 7	14 5	11 6	14 3	10 14	14 4	11 3	178 9	25 8

Twelve Cows.—Sewaged Grass.

Cows' Nos.	Breed.	Years old	Dates of Calving.	Weights (May 29). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
Food consumed. Grass. From which Field, Plot, and Crop.					—		Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		—	—
Quantities weighed (tons. cwts. qrs. lbs.)					—		0 13 1 22		0 7 1 22		0 7 2 23		0 12 2 19		0 12 0 23		0 13 0 21		3 6 3 13	0 0 3 5
Oilcake (equal parts linseed and rape cake) (tons. cwts. qrs. lbs.)					0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 0 1 8		0 2 1 0	0 0 0 3
Yield of Milk, &c.					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Nov 18	1,178	11 8	9 3	12 6	9 0	11 9	13	11 1	8 12	13 8	8 11	13 7	9 4	12 1	8 10	147 2	21 0
2	Cross Sht.-horn	8	Feb. 2	1,208	11 13	9 6	11 8	8 14	11 12	9 8	10 9	8 5	11 10	8 6	11 3	8 9	11 8	7 3	140 2	20 0
3	Cross Sht.-horn	6	Dec 1	1,153	10 6	6 7	10 7	8 6	10 11	7 4	8 2	7 0	10 7	8 5	11 1	8 4	10 9	7 12	127 1	18 2
4	Cross Sht.-horn	Aged	Jan. 26	972	11 8	8 8	10 13	8 0	12 0	8 4	8 7	8 7	10 14	7 13	11 8	7 13	11 0	8 2	133 1	19 0
5	Cross Sht.-horn	6	Nov. 17	1,107	9 2	8 9	10 0	7 12	9 6	8 3	7 3	7 6	9 15	7 0	9 4	6 8	8 11	6 9	115 8	16 8
6	Cross Sht.-horn	Aged	Jan. 13	1,096	12 10	9 15	13 2	9 4	13 2	9 8	12 2	8 12	13 3	9 1	12 12	10 2	12 6	8 13	154 12	22 2
7	Cross Sht.-horn	6	May 2	1,068	19 8	16 0	19 2	14 14	19 10	14 11	18 0	14 5	22 1	14 1	19 10	14 0	19 12	14 1	239 11	34 4
8	Cross Ayrshire	3	Apr. 13	795	10 0	6 1	10 4	6 15	10 0	8 0	9 7	6 14	10 6	6 13	10 7	7 4	10 11	7 9	122 11	17 8
9	Cross Sht.-horn	Aged	Feb. 16	1,018	11 8	10 11	13 6	9 1	13 5	9 12	12 6	10 3	13 2	9 13	13 8	10 0	13 2	8 13	158 10	22 11
10	Ayrshire	6	Apr. 3	960	17 4	13 6	17 16	12 11	16 2	12 8	16 12	12 9	17 7	12 8	16 13	12 12	17 9	12 3	210 6	30 1
11	Guernsey	4	Mar. 30	856	12 6	9 9	13 7	8 4	12 10	8 15	12 8	8 10	11 13	10 7	11 11	10 1	12 11	9 11	158 11	21 13
12	Cross Sht.-horn	7	Nov. 16	1,000	12 9	10 0	14 7	8 12	12 12	9 11	12 2	9 7	13 5	9 2	12 4	9 4	13 13	6 8	155 0	22 2
			Totals -	12,4[illegible]0	130 2	121 15	156 13	111 13	154 15	116 1	138 11	110 12	150 11	112 0	152 8	113 13	152 13	107 14	1,856 11	—
			Means -	1,038	12 8	10 3	13 1	9 5	12 15	9 11	11 9	9 3	13 1	9 5	12 11	9 8	12 12	9 0	154 12	22 2

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—June 20 to June 26.

THREE COWS.—UNSEWAGED GRASS.

Food consumed (tons, cwts., qrs., lbs.):

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass — From which Field, Plot and Crop	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	—	—
Grass — Quantities weighed	0 3 1 11¼	0 4 0 2½	0 4 2 8½	0 4 2 9	0 4 0 8¾	0 3 0 14¾	0 3 1 22½	1 7 0 21	0 1 1 5
Oilcake (equal parts linseed and rape cake)	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 0 9	0 0 2 7	0 0 0 3

Yield of Milk, &c. (lbs. ozs.):

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (June 26). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Mar. 20	1,002	15 6	10 8	14 8	11 1	15 12	11 2	15 9	11 0	14 4	10 12	15 4	10 9	14 12	10 8	180 15	25 14
2	Cross Sht.-horn	7	Dec. 25	1,093	10 8	10 4	11 8	9 0	11 13	10 6	10 4	10 0	10 14	10 3	16 4	10 11	9 11	12 11	148 7	21 3
3	Cross Sht.-horn	Aged	Feb. 28	976	16 14	11 10	15 12	12 6	16 4	12 1	15 0	11 13	15 12	12 0	15 15	12 8	16 9	11 9	196 14	27 13
	Totals			3,161	42 12	32 6	41 13	32 6	43 15	33 9	40 13	33 3	40 14	32 15	41 5	33 12	40 0	34 12	524 4	—
	Means			1,054	14 4	10 13	13 14	10 13	14 10	11 3	13 10	11 1	13 10	11 0	13 12	11 4	13 5	11 9	174 12	24 15

TWELVE COWS.—SEWAGED GRASS.

Food consumed (tons, cwts., qrs., lbs.):

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass — From which Field, Plot, and Crop	Ten-acre, Plot 2, Crop 1.	Ten-acre, Plot 2, Crop 1.	Ten-acre, Plot 2, Crop 1.	Ten-acre, Plot 2, Crop 1.	Ten-acre, Plot 2, Crop 1.	Ten-acre, Plot 2, Crop 1.	Ten-acre, Plot 2, Crop 1.	—	—
Grass — Quantities weighed	0 14 0 19	0 12 1 5	0 11 3 13	0 11 3 18	0 11 3 23	0 12 1 2	0 11 0 24	4 5 2 20	0 1 0 2
Oilcake (equal parts linseed and rape cake)	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 0 1 8	0 2 1 0	0 0 0 3

Yield of Milk, &c. (lbs. ozs.):

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (June 26). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Nov. 18	1,240	12 0	8 6	13 1	8 9	12 0	9 5	11 14	8 12	11 8	9 2	11 8	8 15	11 7	8 12	144 0	20 9
2	Cross Sht.-horn	8	Feb. 2	1,262	11 1	7 7	11 0	7 14	10 15	7 14	10 11	7 9	10 0	8 0	10 12	7 1	10 9	7 4	127 15	18 4
3	Cross Sht.-horn	6	Dec. 1	1,194	10 14	7 12	9 11	7 12	10 11	8 4	10 12	7 9	10 1	8 1	10 9	8 2	10 11	8 3	129 0	18 7
4	Cross Sht.-horn	Aged	Jan. 26	934	10 11	7 9	10 14	7 13	11 6	7 15	11 3	8 1	11 6	8 0	11 6	7 10	11 2	7 12	133 14	19 2
5	Cross Sht.-horn	4	Nov. 17	1,158	8 0	6 0	8 2	6 0	7 12	5 10	7 9	5 11	7 6	6 0	7 10	5 9	7 0	5 7	93 11	13 6
6	Cross Sht.-horn	Aged	Jan. 15	1,120	12 1	8 5	12 3	8 11	12 4	9 0	12 6	8 13	12 8	9 5	12 4	9 9	12 3	9 0	148 8	21 4
7	Cross Sht.-horn	6	May 2	1,084	19 11	13 2	19 9	13 6	19 11	15 12	18 11	13 4	19 6	13 13	17 0	15 9	18 4	14 1	228 5	32 10
8	Cross Ayrshire	3	Apr. 13	767	10 8	6 14	10 0	7 0	10 8	7 4	10 6	7 12	10 12	7 2	10 4	7 4	9 8	7 2	122 4	17 7
9	Cross Sht.-horn	Aged	Feb. 14	1,086	13 1	8 13	11 12	10 4	11 13	10 10	12 5	9 4	13 0	9 4	13 1	8 12	13 1	0 0	153 15	22 0
10	Ayrshire	6	Apr. 8	953	17 2	11 5	16 14	11 6	16 8	12 4	18 8	12 2	16 0	11 4	16 12	10 14	15 13	10 12	186 1	26 9
11	Guernsey	4	Mar. 30	850	11 11	8 14	12 0	9 8	12 6	9 0	11 12	8 8	10 11	8 8	11 15	8 13	11 9	8 7	148 5	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

					Friday.		Saturday.		Sunday.		Monday.		Tuesday.		Wednesday.		Thursday.		Total in 7 days.	Per head per day.
Three Cows.—Unsewaged Grass.																				
Food consumed. Grass	From which Field, Plot, and Crop.				Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		—		Ten-acre, Plot 1, Crop 1.		—		—	—
					tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
	Quantities weighed				0 3 3 23½		0 3 1 6½		0 4 0 20½		0 3 3 24		—		0 4 0 9½		—		0 18 2 0	0 0 3 20
Oilcake (rape-cake)					0 0 0 10½		0 0 0 10½		0 0 0 10½		0 0 0 10½		0 0 0 10½		0 0 0 10½		0 0 0 10½		0 0 2 17½	0 0 0 3½
Cows No.	Breed.	Years old.	Dates of Calving.	Weights (June 26). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Mar 20	1,092	16 13	11 1	14 4	10 0	16 6	10 3	14 1	8 15	14 1	9 15	14 3	11 5	14 15	11 11	177 13	25 6
2	Cross Sht.-horn	7	Dec. 25	1,093	8 0	10 7	8 12	11 15	9 8	11 1	7 3	10 11	8 6	10 7	11 0	10 6	8 12	10 15	157 7	19 10
3	Cross Sht.-horn	Aged	Feb. 26	976	15 4	11 0	14 6	12 1	16 14	12 2	15 0	10 4	14 5	12 0	16 0	10 11	16 4	12 1	168 4	26 14
			Totals -	3,161	40 1	32 8	37 6	34 0	42 12	33 6	36 4	29 14	36 12	33 0	41 3	32 6	39 15	34 11	503 8	—
			Means -	1,054	13 6	10 13	12 7	11 5	14 4	11 2	12 1	9 13	12 4	10 13	13 12	10 13	13 5	11 9	167 13	24 0
Twelve Cows.—Sewaged Grass.																				
Food consumed. Grass	From which Field, Plot, and Crop.				Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 4, Crop 2.		Ten-acre, Plot 00*, Crop 1.		Ten-acre, Plot 4, Crop 2.		Ten-acre, Plot 4, Crop 2.		Ten-acre, Plot 4, Crop 2.		—	—
					tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
	Quantities weighed				0 13 3 2		0 11 3 2		0 17 2 13		0 13 0 7		0 10 3 11		0 12 1 20		0 17 2 9		5 2 0 8	0 1 0 24
Oilcake (rape-cake)					0 0 1 14		0 0 1 14		0 0 1 14		0 0 1 14		0 0 1 14		0 0 1 14		0 0 1 14		0 2 2 14	0 0 0 3½
Cows No.	Breed.	Years old.	Dates of Calving.	Weights (June 26). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Nov. 18	1,240	11 8	8 4	11 0	8 9	11 0	10 2	10 6	7 10	10 11	8 9	11 10	8 10	11 12	8 9	136 4	19 12
2	Cross Sht.-horn	8	Feb. 2	1,262	9 10	7 0	9 4	7 1	9 10	8 0	8 4	9 11	8 10	7 8	9 8	7 2	9 11	7 6	113 5	16 8
3	Cross Sht.-horn	6	Dec. 1	1,134	10 11	8 0	10 6	8 0	11 6	8 4	9 7	7 6	10 0	8 6	11 9	7 9	11 4	8 0	130 4	18 10
4	Cross Sht.-horn	Aged	Jan. 21	894	10 6	7 6	10 6	8 0	10 12	7 15	10 8	7 3	10 6	8 5	11 4	7 11	11 6	7 14	129 4	18 7
5	Cross Sht.-horn	6	Nov. 17	1,138	7 4	3 4	7 3	6 6	7 12	7 0	7 6	8 13	7 10	8 14	8 12	6 6	9 0	8 12	99 12	14 4
6	Cross Sht.-horn	Aged	Jan. 13	1,129	12 5	8 9	12 0	9 1	12 2	10 5	12 0	7 12	12 0	9 6	12 9	8 10	12 11	9 4	148 10	21 4
7	Cross Sht.-horn	6	May 2	1,084	18 1	12 5	17 2	13 1	10 3	13 12	18 4	12 14	19 0	13 15	19 10	13 10	20 2	14 0	225 2	32 3
8	Cross Ayrshire	3	Apr. 13	797	9 4	7 9	9 11	9 9	10 2	7 14	9 12	8 10	10 4	7 11	11 4	7 6	11 8	7 13	128 5	18 1
9	Cross Sht.-horn	Aged	Feb. 16	1,088	12 12	9 10	12 4	11 1	13 2	9 6	10 12	8 4	12 14	9 15	13 0	9 6	14 0	8 13	165 11	22 4
10	Ayrshire -	6	Apr. 3	953	15 14	11 12	16 12	8 8	17 12	12 13	15 4	10 13	16 0	12 9	16 0	11 0	18 8	12 0	197 10	28 4
11	Guernsey -	4	Mar. 30	850	12 1	8 6	12 0	8 4	12 10	9 7	10 4	7 14	11 2	11 2	12 8	9 5	12 15	8 7	148 0	20 14
12	Cross Sht.-horn	7	Nov. 10	1,142	11 8	8 1	11 4	8 0	12 6	9 4	11 8	7 2	11 4	9 0	12 6	8 14	12 0	7 12	141 4	20 3
			Totals -	12,894	141 4	103 5	139 4	103 9	147 13	114 8	133 11	96 0	130 13	113 11	152 4	105 14	154 13	106 10	1,753 7	—
			Means -	1,075	11 12	8 8	11 10	8 13	12 5	9 9	11 2	8 0	11 11	9 8	12 11	8 13	12 14	8 14	146 2	20 14

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—July 4 to July 10.

THREE COWS.—UNSEWAGED GRASS.

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	Ten-acre, Plot 1, Crop 1.	—	—
	tons. cwts. qrs. lbs.	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*
Grass: Quantities weighed	0 2 0 21½	0 2 2 10½	0 3 1 8½	0 3 1 9	0 3 0 16½	0 4 2 23½	0 4 0 0½	1 3 1 13	0 1 0 13
Oilcake (rape-cake)	0 0 0 10½	0 0 0 10½	0 0 0 10½	0 0 0 10½	0 0 0 10½	0 0 0 10½	0 0 0 10½	0 0 2 17½	0 0 0 3½

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (July 10). *lbs.*	Fri. A.M. *lbs. ozs.*	Fri. P.M. *lbs. ozs.*	Sat. A.M. *lbs. ozs.*	Sat. P.M. *lbs. ozs.*	Sun. A.M. *lbs. ozs.*	Sun. P.M. *lbs. ozs.*	Mon. A.M. *lbs. ozs.*	Mon. P.M. *lbs. ozs.*	Tues. A.M. *lbs. ozs.*	Tues. P.M. *lbs. ozs.*	Wed. A.M. *lbs. ozs.*	Wed. P.M. *lbs. ozs.*	Thurs. A.M. *lbs. ozs.*	Thurs. P.M. *lbs. ozs.*	Total in 7 days. *lbs. ozs.*	Per head per day. *lbs. ozs.*
1	Cross Sht.-horn	6	Mar. 20	1,037	16 0	10 13	14 8	9 0	14 13	10 0	16 14	9 8	12 5	9 3	14 6	11 10	14 10	10 6	173 15	24 14
2	Cross Sht.-horn	7	Dec. 25	1,100	9 3	10 13	9 10	9 1	9 12	9 6	7 7	10 8	7 1	11 5	10 2	10 5	9 6	8 2	133 3	18 14
3	Cross Sht.-horn	Aged	Feb. 26	988	16 3	11 9	16 6	10 11	15 14	11 12	15 0	9 12	14 8	9 12	16 1	11 0	16 14	11 6	186 12	26 11
			Totals	3,175	41 6	33 3	40 8	28 12	40 7	31 2	39 5	29 12	33 14	30 4	40 9	32 15	41 0	29 13	492 14	—
			Means	1,058	13 13	11 1	13 8	9 9	13 8	10 6	13 2	9 15	11 5	10 1	13 6	11 0	13 10	9 15	164 5	23 8

TWELVE COWS.—SEWAGED GRASS.

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	Ten-acre, Plot 4, Crop 2.	Ten-acre, Plot 4, Crop 2.	Ten-acre, Plot 4, Crop 2.	Ten-acre, Plot 4, Crop 2.	Ten-acre, Plot 4, Crop 2.	Ten-acre, Plot 4, Crop 2.	Ten-acre, Plot 4, Crop 2.	—	—
	tons. cwts. qrs. lbs.	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*
Grass: Quantities weighed	0 14 3 25	0 7 0 23	0 15 0 17	0 15 0 25	0 16 1 6	0 16 1 11	0 17 2 19	5 8 3 14	0 1 0 25
Oilcake (rape-cake)	0 0 1 14	0 0 1 14	0 0 1 14	0 0 1 14	0 0 1 14	0 0 1 14	0 0 1 14	0 2 2 14	0 0 0 3½

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (July 10). *lbs.*	Fri. A.M. *lbs. ozs.*	Fri. P.M. *lbs. ozs.*	Sat. A.M. *lbs. ozs.*	Sat. P.M. *lbs. ozs.*	Sun. A.M. *lbs. ozs.*	Sun. P.M. *lbs. ozs.*	Mon. A.M. *lbs. ozs.*	Mon. P.M. *lbs. ozs.*	Tues. A.M. *lbs. ozs.*	Tues. P.M. *lbs. ozs.*	Wed. A.M. *lbs. ozs.*	Wed. P.M. *lbs. ozs.*	Thurs. A.M. *lbs. ozs.*	Thurs. P.M. *lbs. ozs.*	Total in 7 days. *lbs. ozs.*	Per head per day. *lbs. ozs.*
1	Cross Sht.-horn	6	Nov. 18	1,190	11 13	8 10	11 6	8 10	12 0	10 0	11 2	8 12	11 13	8 5	11 2	8 8	11 15	8 6	142 3	20 7
2	Cross Sht.-horn	8	Feb. 2	1,263	9 0	7 12	9 12	7 0	9 4	7 6	9 13	7 0	9 0	7 0	9 12	7 3	9 10	7 5	116 12	16 11
3	Cross Sht.-horn	6	Dec. 1	1,204	11 0	8 5	10 11	8 2	11 2	8 8	10 13	8 4	11 0	8 5	11 6	8 8	11 9	8 7	136 11	19 8
4	Cross Sht.-horn	Aged	Jan. 26	983	11 10	8 4	11 6	7 10	11 6	8 9	10 10	8 2	11 2	6 9	12 4	8 11	12 3	8 9	138 15	19 14
5	Cross Sht.-horn	6	Nov. 17	1,132	8 6	7 2	9 2	7 2	9 4	7 13	8 6	7 0	8 4	6 13	9 3	6 12	8 6	6 14	110 7	15 12
6	Cross Sht.-horn	Aged	Jan. 13	1,118	12 2	9 0	12 10	9 11	12 13	9 8	12 4	8 4	12 3	8 13	12 10	9 12	12 10	9 2	151 6	21 10
7	Cross Sht.-horn	6	May 2	1,039	10 8	13 13	19 4	14 8	19 7	15 2	18 8	13 0	18 13	14 0	18 14	14 4	19 0	14 8	203 13	28 4
8	Cross Ayrshire	5	Apr. 13	822	11 0	7 11	11 0	8 4	11 12	8 0	11 0	7 3	10 14	7 12	11 10	8 0	11 14	7 13	134 6	19 3
9	Cross Sht.-horn	Aged	Feb. 10	1,082	13 0	9 9	12 13	9 10	12 11	10 8	13 0	8 9	12 8	9 4	12 11	9 15	12 14	9 4	158 4	22 6

THREE COWS.—UNSEWAGED GRASS.

Food consumed.		Friday.		Saturday.		Sunday.		Monday.		Tuesday.		Wednesday.		Thursday.		Total in 7 days.	Per day.
Grass	From which Field, Plot, and Crop.	—		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 0*, Crop 1.		Ten-acre, Plot 0*, Crop 1.		—	—
		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass	Quantities weighed			0 2 1 24½		0 2 2 12½		0 2 2 9		0 2 1 25		0 3 0 25½		0 2 1 21½		0 14 3 6	0 0 2 23
Oilcake (1 part linseed and 3½ parts rape cake)		0 0 0 13½		0 0 0 13½		0 0 0 13½		0 0 0 13½		0 0 0 13½		0 0 0 13½		0 0 0 13½		0 0 3 10½	0 0 0 4½

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (July 10). lbs.	Friday A.M.	Friday P.M.	Saturday A.M.	Saturday P.M.	Sunday A.M.	Sunday P.M.	Monday A.M.	Monday P.M.	Tuesday A.M.	Tuesday P.M.	Wednesday A.M.	Wednesday P.M.	Thursday A.M.	Thursday P.M.	Total in 7 days	Per day
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Mar. 20	1,087	14 10	9 4	13 2	9 12	13 7	10 9	15 0	10 5	14 10	10 1	14 12	10 0	13 11	9 4	161 7	24 1
2	Cross Sht.-horn	7	Dec. 25	1,100	9 2	9 15	9 7	9 15	8 12	10 1	11 0	7 13	9 0	10 12	8 7	9 1	8 8	9 0	130 12	18 11
3	Cross Sht.-horn	Aged	Feb. 28	988	13 8	12 6	13 0	10 8	13 1	11 5	16 2	11 2	14 5	11 0	15 4	11 0	15 0	10 2	180 1	25 12
	Totals			3,175	37 4	31 0	35 15	30 3	37 4	31 16	42 2	29 4	37 15	31 13	38 7	30 1	37 3	28 6	479 5	—
	Means			1,058	12 7	10 8	12 0	10 1	12 7	10 10	14 1	9 12	12 10	10 10	12 13	10 0	12 6	9 7	159 12	22 13

TWELVE COWS.—SEWAGED GRASS

Food consumed.		Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per day.
Grass	From which Field, Plot, and Crop.	Ten-acre, Plot 4, Crop 2.	Ten-acre, Plot 4, Crop 2.	Ten-acre, Plot 4, Crop 2.	Ten-acre, Plot 3, Crop 2.	Ten-acre, Plot 3, Crop 2.	Ten-acre, Plot 3, Crop 2.	Ten-acre, Plot 3, Crop 2.	—	—
		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass	Quantities weighed	0 15 2 12	0 15 2 21	0 6 3 9	1 6 2 11	0 11 3 23	0 14 1 5	0 17 3 7	5 8 3 2	0 1 1 5
Oilcake (1 part linseed and 3½ parts rape cake)		0 0 1 26	0 0 1 26	0 0 1 26	0 0 1 26	0 0 1 26	0 0 1 26	0 0 1 26	0 3 1 14	0 0 0 4½

Cows. Nos.	Breed	Years old.	Dates of Calving.	Weights (July 10). lbs.	Friday A.M.	Friday P.M.	Saturday A.M.	Saturday P.M.	Sunday A.M.	Sunday P.M.	Monday A.M.	Monday P.M.	Tuesday A.M.	Tuesday P.M.	Wednesday A.M.	Wednesday P.M.	Thursday A.M.	Thursday P.M.	Total in 7 days	Per day
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Nov. 18	1,100	11 12	9 4	11 10	8 10	11 12	6 13	13 1	7 10	12 2	6 13	11 0	9 4	12 3	9 0	143 5	20 5
2	Cross Sht.-horn	8	Feb. 2	1,263	10 7	7 2	9 3	7 8	9 8	6 13	9 5	6 12	10 0	7 1	8 10	7 2	9 6	6 10	115 7	16 8
3	Cross Sht.-horn	6	Dec. 1	1,204	10 11	8 0	10 8	8 7	11 6	8 12	11 2	8 11	10 8	6 9	11 3	9 0	11 0	8 14	136 11	19 8
4	Cross Sht.-horn	Aged	Jan. 26	983	11 6	7 0	11 3	8 0	11 12	8 12	11 8	8 7	11 3	8 12	11 12	8 4	11 0	8 0	137 5	19 10
5	Cross Sht.-horn	6	Nov. 17	1,132	8 12	6 3	7 11	7 7	8 2	6 13	8 6	7 7	7 6	7 4	9 0	6 14	8 4	6 12	106 11	15 4
6	Cross Sht.-horn	Aged	Jan. 13	1,116	12 14	6 1	12 4	9 3	12 10	6 6	13 10	6 6	11 0	9 6	12 13	9 2	12 7	9 4	147 6	21 1
7	Cross Sht.-horn	6	May 2	1,099	20 0	11 0	19 2	12 4	19 0	13 13	19 6	14 8	17 10	14 0	19 6	13 13	19 1	11 4	224 12	32 2
8	Cross Ayrshire	3	Apl. 13	822	12 5	7 1	11 8	7 15	11 8	8 3	11 7	8 1	10 9	8 6	11 0	7 13	11 12	7 14	135 12	19 6
9	Cross Sht.-horn	Aged	Feb. 16	1,082	12 15	8 10	12 6	10 12	12 2	9 1	12 2	8 9	11 10	9 10	13 2	9 0	12 8	8 12	161 8	21 10
10	Ayrshire	6	Apl. 3	918	17 11	10 10	16 7	12 0	17 9	12 4	17 12	10 12	15 6	12 10	18 0	12 13	18 2	12 11	205 1	29 5
11	Guernsey	4	Mar. 30	624	13 0	8 5	12 9	9 0	12 15	9 15	12 8	9 14	11 8	9 6	12 0	9 10	12 15	9 10	153 3	21 14
12	Cross Sht.-horn	7	Nov. 16	1,110	13 1	7 12	11 6	8 7	12 6	8 13	11 5	8 10	11 7	8 12	12 8	8 11	12 13	8 12	144 14	20 11
	Totals			12,755	154 14	98 15	146 18	109 9	130 10	106 6	151 8	107 11	140 5	112 8	151 14	111 9	151 7	107 7	1,800 8	—

Yield of Milk, &c.

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—July 18 to July 24.

Three Cows.—Unsewaged Grass.

ood con-sumed.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop	Ten-acre, Plot 0,* Crop 1.	—	Ten-acre, Plot 0,* Crop 1.	Ten-acre, Plot 0,* Crop 1.	Ten-acre, Plot 0,* Crop 1.	†	Ten-acre, Plot 0,* Crop 1.	—	—
	tons. cwts. qrs. lbs.	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*
Grass: Quantities weighed	0 3 0 18½	..	0 1 1 13	0 1 1 14	0 2 2 2	0 1 3 15	0 3 2 16	0 13 3 22½	0 0 2 18
Oilcake (1 part linseed and 3½ parts rape cake)	0 0 0 13½	0 0 0 13½	0 0 0 13½	0 0 0 13½	0 0 0 13½	0 0 0 13½	0 0 0 13½	0 0 3 10½	0 0 0 4½

Cows No.	Breed.	Years old.	Dates of Calving.	Weights (July 24). *lbs.*	Friday A.M. *lbs. ozs.*	Friday P.M. *lbs. ozs.*	Saturday A.M. *lbs. ozs.*	Saturday P.M. *lbs. ozs.*	Sunday A.M. *lbs. ozs.*	Sunday P.M. *lbs. ozs.*	Monday A.M. *lbs. ozs.*	Monday P.M. *lbs. ozs.*	Tuesday A.M. *lbs. ozs.*	Tuesday P.M. *lbs. ozs.*	Wednesday A.M. *lbs. ozs.*	Wednesday P.M. *lbs. ozs.*	Thursday A.M. *lbs. ozs.*	Thursday P.M. *lbs. ozs.*	Total in 7 days *lbs. ozs.*	Per head per day *lbs. ozs.*
1	Cross Sht.-horn	6	Mar. 20	1,090	14 0	9 0	14 0	9 14	14 10	9 13	13 3	9 2	15 2	8 14	14 8	10 0	14 3	9 11	163 15	23 7
2	Cross Sht.-horn	7	Dec. 23	1,127	9 1	9 8	8 0	7 12	8 2	9 0	6 5	10 12	6 5	9 9	8 6	9 10	8 14	8 8	118 10	16 15
3	Cross Sht.-horn	Aged	Feb. 26	1,011	14 12	10 9	15 6	10 12	14 10	11 0	15 0	10 4	14 15	10 11	15 2	11 10	15 12	11 16	183 6	26 1
			Totals	3,223	37 13	20 1	37 6	28 6	37 6	29 13	33 0	30 2	34 6	29 2	37 10	31 4	39 2	[illegible] 2	464 15	—
			Means	1,076	12 10	9 11	12 7	9 7	12 7	9 15	11 2	10 1	11 7	9 11	12 9	10 7	13 1	10 1	165 0	22 2

Twelve Cows.—Sewaged Grass.

ood con-sumed.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop	Ten-acre, Plot 3, Crop 2	Ten-acre, Plot 3, Crop 2	Ten acre, Plots 2 and 3, Crop 2	Ten-acre, Plots 2 and 3, Crop 2.	†	†	†	—	—
	tons. cwts. qrs. lbs.	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*
Grass: Quantities weighed	0 13 1 27	0 13 3 12	0 13 3 27	0 13 3 27	0 7 3 22	0 10 0 9	0 18 2 14	4 13 3 26	0 1 0 13
Oilcake (1 part linseed and 3½ parts rape cake)	0 0 1 26	0 0 1 26	0 0 1 26	0 0 1 26	0 0 1 26	0 0 1 26	0 0 1 28	0 3 1 14	0 0 0 4½

Cows No.	Breed.	Years old.	Dates of Calving.	Weights (July 24). *lbs.*	Friday A.M. *lbs. ozs.*	Friday P.M. *lbs. ozs.*	Saturday A.M. *lbs. ozs.*	Saturday P.M. *lbs. ozs.*	Sunday A.M. *lbs. ozs.*	Sunday P.M. *lbs. ozs.*	Monday A.M. *lbs. ozs.*	Monday [illegible] *lbs. ozs.*	Tuesday A.M. *lbs. ozs.*	Tuesday P.M. *lbs. ozs.*	Wednesday A.M. *lbs. ozs.*	Wednesday P.M. *lbs. ozs.*	Thursday A.M. *lbs. ozs.*	Thursday P.M. *lbs. ozs.*	Total in 7 days *lbs. ozs.*	Per head per day *lbs. ozs.*
1	Cross Sht.-horn	6	Nov. 18	1,193	11 12	9 2	12 1	8 10	11 14	9 0	11 2	9 0	11 8	0 2	11 12	8 12	12 0	8 4	144 5	20 10
2	Cross Sht.-horn	8	Feb. 2	1,246	9 2	6 4	7 12	6 0	7 13	6 14	8 12	4 4	8 14	7 0	8 14	6 10	8 11	7 1	105 16	15 2
3	Cross Sht.-horn	6	Dec. 1	1,232	10 13	8 5	11 10	8 4	11 9	8 14	11 0	6 1	10 15	8 3	11 3	7 8	11 0	8 9	135 12	19 6
4	Cross Sht.-horn	Aged	Jan. 28	1,000	10 12	8 9	10 14	7 12	10 12	6 13	10 3	7 10	10 10	8 2	11 1	8 1	11 6	7 10	130 5	18 10
5	Cross Sht.-horn	6	Nov. 17	1,176	7 14	7 8	8 10	6 12	8 5	6 6	7 8	7 2	8 4	6 10	6 12	7 0	8 12	6 7	104 9	14 15
6	Cross Sht.-horn	Aged	Jan. 13	1,121	12 4	8 5	12 7	8 15	12 15	9 8	12 4	9 1	12 12	9 5	12 2	9 6	12 2	9 8	150 14	21 9
7	Cross Sht.-horn	6	May 2	1,071	17 0	14 13	18 14	13 0	17 8	12 4	18 13	13 0	18 2	12 2	18 6	12 4	18 12	11 11	216 9	30 15
8	Cross Ayrshire	8	Apr. 13	821	11 4	7 15	12 0	7 13	10 7	7 8	10 14	7 1	10 0	6 4	9 10	6 10	10 14	7 9	125 8	17 15
9	Cross Sht.-horn	Aged	Feb. 16	1,116	12 8	0 0	12 2	9 13	12 0	0 12	12 10	9 11	12 10	9 5	12 11	9 1	12 15	9 7	154 5	22 1
10	Ayrshire	6	Apr. 3	863	17 2	11 12	18 0	12 4	17 4	12 1	17 13	13 4	16 14	12 5	16 12	12 4	18 0	12 6	207 0	29 9
11	Guernsey	4	Mar. 30	834	13 4	9 6	12 13	8 11	12 13	10 1	12 8	9 5	10 11	9 14	12 10	9 4	12 11	9 8	154 7	22 1

... (7 days.—July 25 to July 31.

Three Cows.—Unsewaged Grass.

		Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
ood con-sumed. Grass	From which Field, Plot, and Crop.	Ten-acre, Plot 0,* Crop 2.	Ten-acre, Plot 0,* Crop 2.	Ten-acre, Plot 0,* Crop 2.	Ten-acre, Plot 0,* Crop 2	†	†	†	—	—
	(tons. cwts. qrs. lbs.)									
Grass	Quantities weighed	0 4 3 10	0 3 3 24	0 3 1 23	0 3 1 23	0 5 2 6	0 4 2 10	0 4 0 21	1 10 0 11	0 1 1 21
Oilcake	(rape-cake)	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 3 0	0 0 0 4

Cows No.	Breed.	Years old.	Dates of Calving.	Weights (July 24) lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. [illegible]	Tue. A.M.	Tue. P.M.	Wed. A.M.	Wed. P.M.	Thu. A.M.	Thu. P.M.	Total in 7 days	Per head per day
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Mar. 20	1,090	14 1	10 0	14 6	10 4	14 0	13 4	13 8	10 0	14 0	10 11	15 2	11 3	15 0	10 8	177 1	25 5
2	Cross Sht.-horn	7	Dec. 23	1,127	8 2	9 11	9 8	9 0	8 1	11 14	7 10	9 4	8 15	9 8	8 7	9 0	7 4	9 12	126 6	18 1
3	Cross Sht.-horn	Aged	Feb. 28	1,011	15 7	11 8	16 8	11 1	15 4	10 15	14 0	10 6	15 11	11 5	16 2	10 6	15 9	11 1	165 3	23 7
	Totals -			3,228	37 10	31 12	40 6	30 11	37 5	36 1	35 2	29 10	39 3	31 6	39 11	30 9	37 13	31 5	488 10	—
	Means -			1,076	12 9	10 0	13 7	10 4	12 7	12 0	11 11	9 14	13 1	10 6	13 4	10 3	12 10	10 7	162 14	23 4

Twelve Cows.—Sewaged Grass.

		Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
od con-sumed. Grass	From which Field, Plot, and Crop.	Ten-acre, Plots 00* and 2, Crop 2	Ten-acre, Plot 00*, Crop 2.	‡	‡	‡	‡	Five-acre, Plot 4, Crop 2.	—	—
	(tons. cwts. qrs. lbs.)									
Grass	Quantities weighed	0 13 1 6	0 11 1 24	0 10 1 22	0 10 1 22	0 14 0 14	0 12 2 0	0 12 0 25	4 4 2 1	0 1 0 1
Oilcake	(rape-cake)	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 3 0 0	0 0 0 4

Cows No.	Breed.	Years old.	Dates of Calving.	Weights (July 24). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tue. A.M.	Tue. P.M.	Wed. A.M.	Wed. P.M.	Thu. A.M.	Thu. P.M.	Total in 7 days	Per head per day
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Nov. 18	1,192	11 8	8 8	11 12	9 0	11 10	9 7	10 12	8 9	11 11	9 0	11 12	9 0	11 8	8 7	142 14	20 7
2	Cross Sht.-horn	6	Feb. 2	1,246	9 4	6 7	9 2	6 8	8 12	6 2	9 2	6 0	8 10	7 0	9 11	6 8	9 10	6 4	106 0	15 7
3	Cross Sht.-horn	6	Dec. 1	1,232	10 11	7 7	11 0	7 14	11 2	8 0	10 0	7 0	10 6	8 2	10 14	7 8	10 4	7 8	128 2	18 5
4	Cross Sht.-horn	Aged	Jan. 20	1,000	11 12	7 11	11 10	7 7	11 11	7 4	9 12	7 10	11 6	7 8	11 0	7 12	11 2	7 9	131 2	18 12
5	Cross Sht.-horn	6	Nov. 17	1,176	8 11	6 0	8 10	7 4	8 7	6 15	8 2	6 3	8 7	7 3	7 12	7 0	8 6	6 4	105 10	15 1
6	Cross Sht.-horn	Aged	Jan. 13	1,121	12 15	8 13	12 6	9 12	12 2	9 13	12 0	9 2	12 7	9 12	12 0	8 10	12 2	9 0	150 14	21 9
7	Cross Sht.-horn	6	May 2	1,071	20 2	11 11	19 12	13 3	19 1	13 13	17 13	13 0	19 12	13 13	18 8	13 2	18 0	13 4	224 14	32 2
8	Cross Ayrshire	3	Apr. 13	824	11 12	8 1	12 4	6 0	11 12	7 15	11 10	8 1	11 6	8 0	10 12	7 0	10 12	7 12	135 0	19 5
9	Cross Sht.-horn	Aged	Feb. 16	1,116	12 1	8 11	12 7	9 7	12 15	12 14	11 6	8 12	11 7	9 3	11 14	8 6	12 1	9 10	161 2	21 9
10	Ayrshire -	6	Apr. 3	852	17 6	11 4	10 12	11 13	17 0	12 13	17 8	11 9	17 5	12 4	17 3	12 1	16 8	12 14	204 6	29 3
11	Guernsey -	4	Mar 30	854	13 7	9 4	13 10	8 14	12 10	9 3	13 7	8 10	13 1	9 2	13 4	8 6	12 10	8 10	154 2	22 0
12	Cross Sht.-horn	7	Nov. 16	1,162	12 7	8 15	12 8	8 4	12 0	8 7	11 4	8 15	12 2	8 0	12 12	7 6	11 10	8 0	143 0	20 7
	Totals -			12,948	162 2	102 12	151 13	107 0	140 2	112 10	142 12	103 13	147 15	100 11	147 6	103 1	143 9	105 2	1,770 2	—
	Means -			1,079	13 11	8 9	12 11	8 15	11 7	9 6	11 14	8 11	12 3	9 2	12 5	8 9	11 15	8 12	148 4	21 3

Yield of Milk, &c.

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—August 1 to August 7.

Three Cows.—Unsewaged Grass.

Food consumed (tons, cwts., qrs., lbs.):

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop	Five-acre, Plot 1, Crop 1.	Five-acre, Plot 1, Crop 1.	—	—	Ten-acre, Plot 0*, Crop 2.	Ten-acre, Plot 0*, Crop 2.	—	—	—
Grass: Quantities weighed	0 2 1 17	0 1 2 22	– – – –	– – – –	0 6 0 3	0 5 3 24	– – – –	0 16 0 10	0 0 3 9
Oilcake	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0

Milk yielded (lbs., ozs.):

Cows' Nos.	Breed.	Years old.	Dates of Calving.	Weights (July 24). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Mar. 20	1,090	13 9	10 1	12 8	8 12	13 14	8 11	13 10	9 6	13 4	9 11	14 3	9 8	14 2	10 9	163 12	23 4
2	Cross Sht.-horn	7	Dec. 25	1,127	7 11	0 0	5 0	5 11	6 8	9 1	6 4	8 3	7 2	7 12	8 2	7 0	9 0	7 11	104 1	14 14
3	Cross Sht.-horn	Aged	Feb. 26	1,011	16 9	10 0	13 4	11 2	14 0	10 1	15 4	9 4	11 6	10 5	16 0	10 6	15 8	11 2	177 5	25 5
	Totals			3,228	30 13	29 1	30 12	25 9	33 6	27 13	35 2	26 13	34 12	27 12	38 5	26 14	38 10	29 6	444 0	—
	Means			1,076	13 4	9 11	10 4	8 9	11 2	9 4	11 12	8 15	11 9	9 4	12 13	8 15	12 14	9 13	148 0	21 2

Twelve Cows.—Sewaged Grass.

Food consumed (tons, cwts., qrs., lbs.):

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop	Five-acre, Plot 4, Crop 2.	Five-acre, Plot 4, Crop 2.	Five-acre, Plot 4, Crop 2.	†	†	†	†	—	—
Grass: Quantities weighed	0 9 3 10	0 9 3 5	0 11 3 8	0 9 1 22	0 14 2 2	0 17 2 14	0 10 3 27	4 4 0 4	0 1 0 0
Oilcake	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0

Milk yielded (lbs., ozs.):

Cows' Nos.	Breed.	Years old.	Dates of Calving.	Weights (July 24). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Nov. 18	1,192	11 14	8 2	11 8	8 10	11 10	9 1	12 0	9 0	11 9	8 14	12 0	8 9	11 7	8 8	142 12	20 6
2	Cross Sht.-horn	8	Feb. 2	1,246	8 9	6 7	8 7	6 0	7 12	6 10	8 2	5 14	8 0	6 5	8 12	6 14	8 8	6 10	102 14	14 11
3	Cross Sht.-horn	6	Dec. 1	1,232	10 5	7 8	10 3	7 6	10 2	8 1	11 0	7 14	10 1	7 6	10 11	7 9	10 9	7 1	124 12	17 13
4	Cross Sht.-horn	Aged	Jan. 26	1,000	10 10	7 9	11 14	8 4	11 1	8 2	11 2	7 4	10 4	8 3	11 12	7 14	11 5	8 4	133 8	19 1
5	Cross Sht.-horn	6	Nov. 17	1,176	9 2	6 8	7 14	6 10	7 14	6 3	8 12	6 4	7 6	6 8	9 1	6 6	8 11	6 12	104 3	14 14
6	Cross Sht.-horn	Aged	Jan. 13	1,121	12 3	9 3	12 5	8 12	12 2	9 11	13 3	9 1	12 7	8 11	13 4	8 13	12 4	9 8	149 15	21 7
7	Cross Sht.-horn	6	May 3	1,071	18 15	13 3	18 14	14 9	18 1	14 2	19 12	14 0	18 3	13 10	19 0	7 12	18 6	12 13	221 4	31 10
8	Cross Ayrshire	3	Apr. 15	824	13 0	7 14	11 7	8 5	11 12	8 14	13 0	8 4	11 2	8 0	11 12	9 3	12 4	7 15	142 2	20 5
9	Cross Sht.-horn	Aged	Feb. 16	1,118	11 12	9 8	11 8	9 8	10 2	9 13	11 4	7 15	10 3	9 11	11 14	8 11	10 15	9 8	142 2	20 5
10	Ayrshire	6	Apr. 3	903	17 12	11 7	17 5	12 7	17 1	11 14	16 7	12 2	16 15	12 3	17 8	12 13	16 3	11 11	207 12	29 11
11	[illegible]	4	Mar. 26	851	13 9	9 10	12 10	10 1	12 13	10 3	14 6	6 9	11 8	8 6	11 3	9 4	11 11	9 4	152 11	21 13

Three Cows.—Unsewaged Grass.

Food consumed.

	Friday.	Saturday.	Sunday.	Monday.	[redacted]day.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass — From which Field, Plot, and Crop.	Ten-acre, Plot 6,* Crop 2.	†	†	†	†	†	†	—	—
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass — Quantities weighed	0 7 1 13	0 6 0 0	0 3 0 13	0 3 0 13	0 4 0 16	0 5 1 11	0 3 3 12	1 13 3 22	0 1 2 8
Oilcake (rape-cake)	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 3 0	0 0 0 4

Yield of Milk, &c. (lbs. ozs.)

Cows No.	Breed.	Years old.	Dates of Calving.	Weights (July 24). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	[redacted] A.M.	[redacted] P.M.	Wed. A.M.	Wed. P.M.	Thur. A.M.	Thur. P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Mar 20	1,000	14 0	10 0	13 12	9 5	15 0	10 11	15 1	10 10	14 8	10 2	14 12	9 10	14 4	10 0	172 6	24 10
2	Cross Sht.-horn	7	Dec. 25	1,127	8 6	7 2	7 11	8 5	8 6	9 0	8 0	8 5	7 9	7 0	7 10	8 6	7 6	7 9	110 11	15 13
3	Cross Sht.-horn	Aged	Feb. 26	1,011	15 2	10 2	14 11	11 1	15 5	9 3	15 10	10 13	13 0	10 12	15 4	10 2	14 9	10 15	176 9	25 4
	Totals -			3,228	37 8	27 4	36 2	28 11	39 1	28 14	38 11	29 12	35 1	27 14	37 10	28 7	36 3	28 8	459 10	-
	Means -			1,076	12 8	9 1	12 1	9 9	13 0	9 10	12 14	9 14	11 11	9 5	12 9	9 8	12 1	9 8	153 3	21 14

Twelve Cows.—Sewaged Grass.

Food consumed.

	Friday.	Saturday.	Sunday.	Monday.	[redacted]day.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass — From which Field, Plot, and Crop.	‡	‡	‡	‡	‡	‡	‡	—	—
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass — Quantities weighed	0 17 1 9	0 13 0 3	0 11 1 5	0 11 1 5	0 15 0 14	0 15 0 5	0 10 3 4	4 13 2 17	0 1 0 13
Oilcake (rape-cake)	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 5 0 0	0 0 0 4

Yield of Milk, &c. (lbs. ozs.)

Cows No.	Breed.	Years old.	Dates of Calving.	Weights (July 24). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	[redacted] A.M.	[redacted] P.M.	Wed. A.M.	Wed. P.M.	Thur. A.M.	Thur. P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Nov 16	1,102	11 12	8 8	11 12	8 10	12 0	9 14	11 12	8 5	11 10	8 9	11 13	8 15	11 12	8 12	143 14	20 9
2	Cross Sht.-horn	8	Feb. 2	1,246	8 4	6 10	9 0	6 2	9 1	7 5	9 6	6 10	9 12	6 10	9 10	5 8	8 9	6 13	109 3	15 10
3	Cross Sht.-horn	6	Dec. 1	1,232	9 0	7 0	10 4	7 6	10 2	8 2	10 4	7 7	10 3	7 6	10 10	7 9	10 2	7 13	123 3	17 10
4	Cross Sht.-horn	Aged	Jan. 20	1,000	11 4	8 9	11 2	7 10	11 6	7 13	10 12	7 6	11 2	8 1	11 8	7 12	10 4	8 4	122 12	18 15
5	Cross Sht.-horn	6	Nov. 17	1,176	8 6	6 15	8 14	6 5	8 7	7 2	8 8	5 11	7 12	6 14	9 0	6 8	8 13	6 13	105 15	15 2
6	Cross Sht.-horn	Aged	Jan. 13	1,121	12 10	8 4	12 4	8 12	12 0	9 15	11 14	9 3	13 0	9 0	12 13	8 15	12 11	9 13	161 8	21 10
7	Cross Sht.-horn	6	May 2	1,071	18 0	13 2	18 5	13 6	18 7	14 9	18 14	13 0	18 0	12 14	18 4	12 13	18 1	14 4	221 15	31 11
8	Cross Ayrshire	3	Apr 13	824	11 4	8 6	11 7	8 7	12 0	8 4	12 5	7 11	10 8	7 8	11 13	8 0	11 7	8 6	157 6	19 10
9	Cross Sht.-horn	Aged	Feb. 16	1,116	10 0	9 4	11 11	8 8	12 0	9 5	12 4	7 8	12 13	9 0	13 0	8 13	12 8	9 5	146 5	20 14
10	Ayrshire -	6	Apr. 3	952	17 0	11 11	17 15	11 10	17 8	12 12	17 [illegible]	10 14	17 6	11 15	18 0	11 13	18 2	12 7	207 0	29 0
11	Guernsey -	4	Mar. 30	854	12 8	8 10	11 6	8 8	12 8	9 8	13 1	8 5	12 0	10 3	13 0	9 8	12 7	9 0	150 14	21 9
12	Cross Sht.-horn	7	Nov. 10	1,162	11 2	8 10	11 14	7 14	12 2	8 3	12 0	8 3	11 12	8 10	11 13	8 4	12 2	8 12	111 5	20 3
	Totals -			12,946	141 9	105 10	145 14	103 2	147 13	119 11	148 8	100 3	145 14	107 0	151 10	104 6	146 14	110 9	1,771 4	—
	Means -			1,079	11 12	8 13	12 2	8 10	12 5	9 6	12 6	8 6	12 3	8 15	12 10	8 11	12 4	9 3	147 10	21 1

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—August 15 to August 21.

THREE COWS.—UNSEWAGED GRASS.

Food consumed (tons. cwts. qrs. lbs.)

—	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop	—	*	*	*	*	*	*	—	—
Grass: Quantities weighed	—	0 4 2 15	0 1 3 4	0 1 3 4	0 3 3 5	0 2 0 12	0 2 3 10	0 16 3 23	0 0 3 6
Oilcake (rape-cake)	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 3 0	0 0 0 4

Yield of Milk, &c. (lbs. ozs.)

Cows No.	Breed.	Years old.	Dates of Calving.	Weights (Aug. 21). lbs.	Friday A.M.	Friday P.M.	Saturday A.M.	Saturday P.M.	Sunday A.M.	Sunday P.M.	Monday A.M.	Monday P.M.	Tuesday A.M.	Tuesday P.M.	Wednesday A.M.	Wednesday P.M.	Thursday A.M.	Thursday P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Mar. 20	1,076	11 4	10 9	15 6	10 13	13 1	10 12	13 12	10 1	15 0	10 6	14 12	10 10	15 2	8 10	177 2	25 5
2	Cross Sht.-horn	7	Dec. 25	1,170	7 0	8 10	8 7	7 14	8 13	8 3	7 4	8 0	8 2	8 0	7 14	8 1	7 13	7 5	109 0	15 10
3	Cross Sht.-horn	Aged	Feb. 26	1,012	15 0	9 8	16 0	11 0	15 11	10 8	15 10	10 8	14 6	10 1	14 14	11 1	14 15	9 10	178 12	25 9
	Totals			3,258	36 4	28 11	39 13	29 11	37 9	29 7	38 10	28 9	37 8	28 7	37 8	29 12	37 14	25 9	465 4	—
	Means			1,086	12 1	9 9	13 4	9 14	12 9	9 13	12 14	9 8	12 8	9 8	12 8	9 15	12 10	8 8	155 1	22 2

TWELVE COWS.—SEWAGED GRASS.

Food consumed (tons. cwts. qrs. lbs.)

—	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop	†	†	†	†	†	Ten-acre, Plot 2, Crop 2.	Ten-acre, Plot 2, Crop 2.	—	—
Grass: Quantities weighed	0 17 0 27	0 15 1 9	0 14 1 13	0 14 1 13	0 18 2 11	0 15 0 15	0 9 1 11	5 4 1 16	0 1 0 27
Oilcake (rape-cake)	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 3 0 0	0 0 0 4

Yield of Milk, &c. (lbs. ozs.)

Cows No.	Breed.	Years old.	Dates of Calving.	Weights (Aug. 21). lbs.	Friday A.M.	Friday P.M.	Saturday A.M.	Saturday P.M.	Sunday A.M.	Sunday P.M.	Monday A.M.	Monday P.M.	Tuesday A.M.	Tuesday P.M.	Wednesday A.M.	Wednesday P.M.	Thursday A.M.	Thursday P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Nov. 18	1,234	11 12	8 0	11 10	8 6	11 10	8 11	10 2	8 0	11 10	8 8	11 8	8 2	11 0	8 10	137 6	19 10
2	Cross Sht.-horn	8	Feb. 2	1,237	8 11	6 8	8 9	6 12	8 9	7 0	8 7	6 1	8 12	6 7	8 4	6 3	8 0	6 1	104 4	14 14
3	Cross Sht.-horn	6	Dec. 1	1,224	10 6	7 8	10 11	7 4	10 7	8 0	9 11	7 8	10 11	7 6	10 0	7 11	9 1	7 8	123 7	17 10
4	Cross Sht.-horn	Aged	Jan. 26	973	11 3	6 14	11 1	7 11	11 0	7 3	11 2	7 6	11 0	7 10	11 0	7 0	10 7	6 14	127 7	18 3
5	Cross Sht.-horn	6	Nov. 17	1,158	9 9	6 4	9 7	6 10	9 6	7 7	8 12	6 4	9 1	6 0	9 4	6 7	9 2	6 9	110 8	15 13
6	Cross Sht.-horn	Aged	Jan. 13	1,125	13 10	9 5	12 6	8 14	13 3	9 4	12 0	8 7	12 4	9 0	12 2	8 7	12 4	8 12	147 12	21 2
7	Cross Sht.-horn	6	May 2	1,100	17 15	13 5	18 0	13 10	17 9	14 4	17 6	12 6	17 2	13 1	17 7	12 13	16 5	13 1	214 4	30 10
8	Cross Ayrshire	5	Apr. 13	854	12 4	8 1	12 15	8 10	12 4	8 3	12 2	8 0	11 7	8 12	12 7	7 14	11 0	8 4	142 1	20 5
9	Cross Sht.-horn	Aged	Feb. 16	1,136	12 2	9 0	13 0	9 2	10 6	10 8	12 5	8 14	11 3	10 0	12 3	8 10	11 14	9 8	148 8	21 3
10	Ayrshire	6	Apr. 3	950	17 9	11 7	18 0	11 10	18 0	10 15	14 1	10 10	17 3	11 0	16 10	10 13	10 0	12 3	200 10	28 11
11	Guernsey	4	Mar. 30	834	12 11	9 0	13 4	9 0	12 2	9 11	12 13	9 0	13 12	9 2	12 3	9 11	12 6	9 6	153 11	21 15
12	Cross Sht.-horn	7	Nov. 16	1,153	11 12	8 10	12 0	5 4	13 0	7 15	12 1	7 6	10 12	8 6	10 13	7 10	10 8	8 0	137 0	19 9
	Totals			12,979	145 8	104 2	151 6	105 6	145 7	105 1	144 11	99 13	144 13	105 7	145 12	101 0	137 13	104 7	1,746 14	—

… 7 days—August 23 to August 29.

Three Cows.—Unsewaged Grass.

						Friday.		Saturday.		Sunday.		Monday.		Tuesday.		Wednesday.		Thursday.		Total in 7 days.	Per head per day.
Food consumed. Grass	From which Field, Plot, and Crop.					*		*		*		*		*		*		*		—	—
						tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
	Quantities weighed				-	0 3 1 13		0 4 3 0		0 2 2 27		0 2 2 26		0 3 2 24		0 2 2 0		0 1 3 1		1 2 2 0	0 1 0 8
Oilcake (equal parts linseed and rape cake)					-	0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 3 0	0 0 0 4
Yield of Milk, &c.	Cows. No.	Breed.	Years old.	Dates of Calving.	Weights (Aug. 21). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
						lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
	1	Cross Sht.-horn	6	Mar. 20	1,076	15 3	12 0	16 2	11 13	16 8	10 9	15 8	10 12	15 0	13 0	14 5	9 12	14 8	11 12	185 10	26 8
	2	Cross Sht.-horn	7	Dec. 25	1,170	9 6	7 0	7 8	7 6	7 8	7 6	6 12	8 12	7 15	8 5	8 12	6 6	6 0	8 0	101 9	14 7
	3	Cross Sht.-horn	Aged	Feb. 20	1,012	15 10	10 8	16 4	10 11	16 3	10 4	16 2	10 4	15 4	11 1	15 4	10 9	15 4	11 3	184 7	26 6
			Totals		3,258	40 3	29 8	39 14	29 14	40 3	28 3	38 6	27 12	38 3	29 6	36 8	26 11	35 10	30 15	471 1	—
			Means		1,086	13 6	9 13	13 5	9 15	13 6	9 6	12 13	9 4	12 12	9 13	12 2	8 14	11 14	10 5	157 0	[illegible] 7

Twelve Cows.—Sewaged Grass.

						Friday.		Saturday.		Sunday.		Monday.		Tuesday.		Wednesday.		Thursday.		Total in 7 days.	Per head per day.
Food consumed. Grass	From which Field, Plot, and Crop.					Ten-acre, Plot 2, Crop 2.		Ten-acre, Plot 2, Crop 2.		Ten-acre, Plot 2, Crop 2.		Ten-acre, Plot 2, Crop 2.		Ten-acre, Plot 2, Crop 2.		Ten-acre, Plot 2, Crop 2.		Ten-acre, Plots 1 and 2, Crop 2, and Plot 4, Crop 3.		—	—
						tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
	Quantities weighed				-	0 15 0 11		0 17 0 19		0 18 0 17		0 18 0 23		0 12 2 25		0 17 0 1		0 16 0 24		5 14 2 7	0 1 1 15
Oilcake (equal parts linseed and rape cake)					-	0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 3 0 0	0 0 0 4
Yield of Milk, &c.	Cows. No.	Breed.	Years old.	Dates of Calving.	Weights (Aug. 21). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
						lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
	1	Cross Sht.-horn	6	Nov. 18	1,224	11 4	8 0	11 0	7 12	11 10	8 2	11 0	8 1	11 12	8 9	11 12	8 4	11 6	8 12	138 10	19 8
	2	Cross Sht.-horn	8	Feb. 2	1,237	8 0	6 1	8 1	6 2	8 10	6 3	7 10	6 0	7 3	6 5	9 0	6 3	8 0	6 13	100 1	14 5
	3	Cross Sht.-horn	6	Dec. 1	1,224	9 8	7 8	10 4	7 0	10 4	7 6	9 0	7 1	9 6	6 5	10 8	7 0	9 12	7 8	118 13	17 0
	4	Cross Sht.-horn	Aged	Jan. 26	973	10 6	7 2	10 0	6 15	10 11	7 5	8 10	7 0	9 8	7 14	11 0	7 0	7 6	7 11	118 8	16 15
	5	Cross Sht.-horn	6	Nov. 17	1,138	8 8	6 1	8 12	6 3	8 9	6 6	8 11	5 10	7 11	7 0	8 11	6 1	8 0	6 9	102 12	14 11
	6	Cross Sht.-horn	Aged	Jan. 13	1,125	13 0	6 13	12 2	9 0	12 7	8 10	12 12	7 12	11 8	9 2	12 8	9 1	12 8	9 4	149 0	21 5
	7	Cross Sht.-horn	4	May 2	1,109	17 2	13 1	18 2	12 2	17 13	12 0	17 6	11 8	15 10	11 0	17 5	10 1	16 13	12 4	202 8	28 15
	8	Cross Ayrshire	3	Apr. 13	834	11 13	7 12	12 6	8 3	12 10	8 8	12 0	7 10	10 12	9 7	12 5	8 1	11 11	8 2	141 10	20 4
	9	Cross Sht.-horn	Aged	Feb. 16	1,136	11 6	9 6	12 0	8 13	11 4	8 3	11 6	7 10	10 8	9 14	12 6	8 8	11 12	8 4	141 4	20 3
	10	Ayrshire	6	Apr. 3	950	17 3	11 6	17 7	12 1	14 10	10 12	15 14	10 4	11 0	12 0	17 0	10 14	16 9	11 10	194 6	27 12
	11	Guernsey	4	Mar. 30	854	13 10	9 4	12 14	6 7	13 9	8 12	12 5	6 6	11 1	10 6	12 3	9 3	12 13	9 0	160 8	21 8
	12	Cross Sht.-horn	7	Nov. 15	1,155	11 0	7 2	11 8	6 6	10 1	7 8	10 14	7 6	11 6	7 14	10 1	6 15	11 12	7 14	137 11	18 4
			Totals		13,079	141 12	101 6	144 8	100 2	143 11	100 0	137 13	94 6	129 10	106 0	143 1	97 8	138 6	103 11	1,683 11	—
			Means		1,088	11 13	8 7	12 1	8 5	12 0	8 5	11 8	7 14	10 13	8 13	12 1	8 2	11 9	8 10	140 5	20 1

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—August 29 to September 4.

THREE COWS.—UNSEWAGED GRASS.

					Friday.		Saturday.		Sunday.		Monday.		Tuesday.		Wednesday.		Thursday.		Total in 7 days.	Per head per day.
Food consumed. Grass. From which Field, Plot, and Crop.					Ten-acre, Plot 1, Crop 2.		Ten-acre, Plot 1, Crop 2.		Ten-acre, Plot 1, Crop 2.		Ten-acre, Plot 1, Crop 2.		Ten-acre, Plot 1, Crop 2.		Ten-acre, Plot 1, Crop 2.		Ten-acre, Plot 1, Crop 2.		—	—
					tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass. Quantities weighed - - -					0 2 2 3½		0 2 1 25½		0 1 2 22½		0 1 2 24		0 2 2 11½		0 3 3 11½		0 3 3 1½		0 18 2 16	0 0 3 15
Oilcake (equal parts linseed and rape cake) -					0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 3 0	0 0 0 4
Yield of Milk, &c. Cows. No.	Breed.	Years old.	Dates of Calving.	Weights (Aug. 21). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	5	Mar. 20	1,078	15 0	11 12	16 0	10 8	15 12	10 1	14 6	9 6	14 4	11 1	13 10	9 14	14 6	10 12	176 12	25 4
2	Cross Sht.-horn	7	Dec. 25	1,170	7 8	5 9	7 14	7 8	6 1	6 10	6 0	7 10	5 10	6 15	6 0	7 10	6 8	6 8	93 15	13 7
3	Cross Sht.-horn	Aged	Feb. 26	1,012	17 0	10 6	16 2	12 0	16 3	10 10	16 3	10 2	16 6	10 4	17 2	11 1	16 0	11 4	190 11	27 4
		Totals	-	3,238	39 8	27 11	40 0	30 0	38 0	27 5	36 9	27 2	36 4	28 4	36 12	28 9	36 14	28 8	461 8	—
		Means	-	1,086	13 3	9 4	13 5	10 0	12 11	9 2	12 3	9 1	12 1	9 6	12 4	9 8	12 5	9 8	153 13	22 0

TWELVE COWS. SEWAGED GRASS.

					Friday.		Saturday.		Sunday.		Monday.		Tuesday.		Wednesday.		Thursday.		Total in 7 days.	Per head per day.
Food consumed. Grass. From which Field, Plot, and Crop.					Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		—	—
					tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass. Quantities weighed - - -					0 18 0 9		0 14 2 5		0 5 0 23		0 5 1 1		0 13 2 14		0 15 2 12		0 13 1 25		4 5 3 5	0 1 0 2
Oilcake (equal parts linseed and rape cake) -					0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 3 0 0	0 0 0 4
Yield of Milk, &c. Cows. No.	Breed.	Years old.	Dates of Calving.	Weights (Aug. 21). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Nov. 18	1,224	11 13	8 7	11 10	8 0	11 11	8 7	11 3	7 12	11 4	8 7	11 13	8 2	11 12	8 10	138 15	19 14
2	Cross Sht.-horn	8	Feb. 2	1,237	8 6	5 8	8 3	5 14	8 4	5 13	7 12	5 14	8 2	6 2	8 12	5 13	8 7	6 2	99 0	14 2
3	Cross Sht.-horn	6	Dec. 1	1,224	10 3	7 0	10 0	8 9	8 0	8 3	8 4	6 4	8 14	7 0	9 8	6 8	9 6	6 10	112 0	16 0
4	Cross Sht.-horn	Aged	Jan. 26	973	10 8	7 0	10 6	6 13	10 0	6 10	9 6	6 8	9 1	6 14	9 6	6 9	9 0	7 5	115 5	16 8
5	Cross Sht.-horn	6	Nov. 17	1,158	9 0	5 10	8 14	6 12	8 0	6 4	7 9	5 2	7 4	5 10	7 10	5 12	7 11	6 1	97 3	13 14
6	Cross Sht.-horn	Aged	Jan. 13	1,125	12 13	8 15	12 11	8 4	12 10	8 6	12 13	7 10	12 0	8 6	12 9	7 15	12 2	8 10	145 12	20 13
7	Cross Sht.-horn	6	May 2	1,109	17 2	12 2	17 14	11 12	17 0	12 15	16 8	10 12	17 8	12 8	17 4	12 2	10 7	11 15	203 14	29 2
8	Cross Ayrshire	5	Apr. 13	884	11 7	7 9	12 10	7 13	11 14	8 8	11 11	7 0	11 5	8 8	12 4	7 4	11 6	8 0	137 2	19 10
9	Cross Sht.-horn	Aged	Feb. 16	1,138	12 11	8 4	12 1	8 4	12 0	9 0	11 4	7 8	12 12	9 5	13 1	8 7	12 5	8 8	145 12	20 13
10	Ayrshire -	6	Apr. 3	950	17 2	11 2	16 1	10 10	15 7	11 0	16 0	8 10	14 6	10 14	14 7	10 1	14 10	10 6	188 5	26 1
11	Guernsey -	4	Mar. 30	854	13 6	9 0	13 0	7 11	13 5	8 15	12 2	6 14	11 6	9 6	12 5	8 1	12 5	7 5	148 14	26 7

Second Season, 1862; 7 days.—September 5 to September 11.

THREE COWS. UNSEWAGED GRASS.

Food consumed		Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass	From which Field, Plot, and Crop.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	—	—
		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
	Quantities weighed	0 3 2 11¼	0 3 1 22¼	0 4 0 14½	0 4 0 17	0 3 3 24½	0 3 0 24½	0 3 3 4½	1 6 1 7	0 1 1 0
Oilcake (equal parts linseed and rape cake)		0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 3 0	0 0 0 4

Yield of Milk, &c. Cows No.	Breed.	Years old.	Dates of Calving.	Weights (Aug. 21). lbs.	Friday A.M. lbs. ozs.	Friday P.M. lbs. ozs.	Saturday A.M. lbs. ozs.	Saturday P.M. lbs. ozs.	Sunday A.M. lbs. ozs.	Sunday P.M. lbs. ozs.	Monday A.M. lbs. ozs.	Monday P.M. lbs. ozs.	Tuesday A.M. lbs. ozs.	Tuesday P.M. lbs. ozs.	Wednesday A.M. lbs. ozs.	Wednesday P.M. lbs. ozs.	Thursday A.M. lbs. ozs.	Thursday P.M. lbs. ozs.	Total in 7 days. lbs. ozs.	Per head per day. lbs. ozs.
1	Cross Sht.-horn	6	Mar. 20	1,070	15 2	9 6	14 14	9 8	14 4	10 3	15 3	10 6	15 0	10 15	16 0	11 0	14 6	10 7	176 13	25 4
2	Cross Sht.-horn	7	Dec. 25	1,170	7 8	6 9	7 14	6 7	4 10	9 2	5 5	6 12	6 12	7 15	7 1	5 13	6 8	6 14	94 2	13 7
3	Cross Sht.-horn	Aged	Feb. 26	1,012	16 11	10 12	16 7	10 8	16 1	10 10	16 8	11 2	17 0	10 15	16 4	11 9	16 2	10 10	191 3	27 5
	Totals			3,258	39 5	26 13	39 3	25 7	34 15	29 15	37 0	28 4	38 12	29 13	39 5	28 6	37 0	27 15	462 1	—
	Means			1,086	13 2	8 15	13 1	8 8	11 10	10 0	12 5	9 6	12 15	9 15	13 2	9 7	12 5	9 5	154 0	22 0

TWELVE COWS.—SEWAGED GRASS.

Food consumed		Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass	From which Field, Plot, and Crop.	Ten-acre, Plot 4, Crop 3.	Ten-acre, Plot 4, Crop 3.	Ten-acre, Plots 3 and 4, Crop 3.	Ten-acre, Plots 3 and 4, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	—	—
		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
	Quantities weighed	0 18 0 11	1 8 2 14	0 15 3 15	0 15 3 21	0 6 1 24	0 16 1 4	0 17 0 26	5 17 2 3	0 1 1 17
Oilcake (equal parts linseed and rape cake)		0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 3 0 0	0 0 0 4

Yield of Milk, &c. Cows No.	Breed.	Years old.	Dates of Calving.	Weights (Aug. 21). lbs.	Friday A.M. lbs. ozs.	Friday P.M. lbs. ozs.	Saturday A.M. lbs. ozs.	Saturday P.M. lbs. ozs.	Sunday A.M. lbs. ozs.	Sunday P.M. lbs. ozs.	Monday A.M. lbs. ozs.	Monday P.M. lbs. ozs.	Tuesday A.M. lbs. ozs.	Tuesday P.M. lbs. ozs.	Wednesday A.M. lbs. ozs.	Wednesday P.M. lbs. ozs.	Thursday A.M. lbs. ozs.	Thursday P.M. lbs. ozs.	Total in 7 days. lbs. ozs.	Per head per day. lbs. ozs.
1	Cross Sht.-horn	6	Nov 18	1,224	11 8	8 8	11 12	8 13	11 14	9 12	11 9	7 8	11 1	7 14	11 12	7 5	11 9	8 0	137 13	19 11
2	Cross Sht.-horn	8	Feb. 2	1,237	8 2	6 11	8 0	5 14	7 6	5 9	7 6	5 6	7 0	5 7	8 1	5 0	7 12	6 6	93 6	13 5
3	Cross Sht.-horn	6	Dec. 1	1,224	9 3	6 12	8 12	6 12	9 1	6 8	8 14	6 0	7 12	6 12	9 2	5 10	8 11	5 15	105 12	15 2
4	Cross Sht.-horn	Aged	Jan. 26	973	9 7	6 4	9 10	7 1	9 4	6 11	8 9	7 0	8 9	6 4	9 13	6 2	8 15	6 3	100 12	15 11
5	Cross Sht.-horn	6	Nov. 17	1,158	7 8	5 7	7 7	5 15	7 2	5 8	7 10	5 1	7 2	6 8	6 8	6 1	7 0	5 3	89 0	12 11
6	Cross Sht.-horn	Aged	Jan. 13	1,126	12 3	8 11	12 3	8 6	12 1	9 0	11 1	7 13	11 10	8 6	12 0	7 13	11 4	8 3	140 11	20 2
7	Cross Sht.-horn	8	May 2	1,109	16 3	12 10	15 14	12 7	17 4	11 8	14 11	11 0	14 0	11 11	16 2	12 0	15 7	11 1	191 14	27 7
8	Cross Ayrshire	8	Apr. 13	834	13 1	8 13	13 0	8 3	12 14	7 10	11 6	7 2	11 0	8 2	13 1	7 13	12 0	7 11	141 12	20 4
9	Cross Sht.-horn	Aged	Feb. 16	1,136	12 4	6 12	11 8	8 11	10 2	8 11	9 12	8 10	10 12	8 1	11 1	7 8	10 12	8 1	134 9	19 4
10	Ayrshire	6	Apr. 3	950	15 14	10 11	15 8	9 10	16 11	9 1	14 4	9 8	15 4	10 12	15 14	10 3	14 2	10 6	177 12	25 6
11	Guernsey	4	Mar. 30	854	12 0	7 14	12 12	9 7	12 0	6 14	11 0	8 0	11 1	8 8	12 5	7 9	8 11	9 11	137 15	19 11
12	Cross Sht.-horn	7	Nov 16	1,155	9 6	6 12	10 4	6 13	10 8	7 5	10 6	8 2	11 9	7 11	12 6	8 8	11 0	6 14	129 14	18 9
	Totals			12,979	138 11	97 13	137 0	93 2	136 3	93 1	126 8	91 2	126 12	94 15	138 4	91 8	127 9	94 10	1,590 2	—

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—September 12 to September 18.

THREE COWS.—UNSEWAGED GRASS.

Food consumed.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	*	*	*	—	—
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass: Quantities weighed - - -	0 4 1 17½	0 3 1 4¼	0 3 1 7½	0 3 1 10	0 4 1 6	0 3 3 3	0 3 3 6	1 6 0 26½	0 1 1 0
Oilcake (equal parts linseed and rape cake) -	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 3 0	0 0 0 4

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). lbs.	Friday A.M. lbs. ozs.	Friday P.M. lbs. ozs.	Saturday A.M. lbs. ozs.	Saturday P.M. lbs. ozs.	Sunday A.M. lbs. ozs.	Sunday P.M. lbs. ozs.	Monday A.M. lbs. ozs.	Monday P.M. lbs. ozs.	Tuesday A.M. lbs. ozs.	Tuesday P.M. lbs. ozs.	Wednesday A.M. lbs. ozs.	Wednesday P.M. lbs. ozs.	Thursday A.M. lbs. ozs.	Thursday P.M. lbs. ozs.	Total in 7 days. lbs. ozs.	Per head per day. lbs. ozs.
1	Cross Sht.-horn	6	Mar. 29	1,066	14 15	11 6	14 15	11 10	11 10	9 14	15 0	10 6	13 4	10 0	13 9	11 4	13 4	9 8	169 9	24 4
2	Cross Sht.-horn	7	Dec. 25	1,190	6 0	7 6	6 1	8 8	6 4	6 11	7 1	7 9	5 0	6 6	6 0	5 9	5 15	6 10	90 0	12 14
3	Cross Sht.-horn	Aged	Feb. 20	1,020	16 12	11 8	16 4	11 5	16 4	9 10	14 10	11 3	12 10	9 12	15 0	11 3	14 10	10 2	180 13	25 13
			Totals -	3,276	37 11	30 4	37 4	31 7	34 2	26 3	36 11	29 2	29 14	26 2	34 9	28 0	33 13	[illegible] 4	440 6	—
			Means -	1,092	12 9	10 1	13 7	10 8	11 6	8 12	12 4	9 11	9 15	8 11	11 9	9 5	11 4	8 7	146 13	21 0

TWELVE COWS.—SEWAGED GRASS.

Food consumed.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	—	—
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass: Quantities weighed - - -	0 15 2 10	0 15 2 15	0 16 3 8	0 15 3 8	1 0 3 20	0 17 1 15	1 0 2 23	6 2 3 21	0 1 1 24
Oilcake (equal parts linseed and rape cake) -	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 3 0 0	0 0 0 4

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18.) lbs.	Friday A.M. lbs. ozs.	Friday P.M. lbs. ozs.	Saturday A.M. lbs. ozs.	Saturday P.M. lbs. ozs.	Sunday A.M. lbs. ozs.	Sunday P.M. lbs. ozs.	Monday A.M. lbs. ozs.	Monday P.M. lbs. ozs.	Tuesday A.M. lbs. ozs.	Tuesday P.M. lbs. ozs.	Wednesday A.M. lbs. ozs.	Wednesday P.M. lbs. ozs.	Thursday A.M. lbs. ozs.	Thursday P.M. lbs. ozs.	Total in 7 days. lbs. ozs.	Per head per day. lbs. ozs.
1	Cross Sht.-horn	6	Nov. 18	1,270	11 6	8 3	10 14	7 14	13 4	8 11	11 8	7 8	11 4	8 4	11 0	7 12	10 12	7 14	136 2	19 7
2	Cross Sht.-horn	8	Feb. 2	1,267	7 8	5 0	7 6	6 3	8 14	6 11	7 8	5 1	7 6	5 10	7 9	6 8	7 4	5 6	91 14	13 2
3	Cross Sht.-horn	6	Dec. 1	1,288	8 14	6 1	8 2	6 9	9 6	7 5	7 10	6 0	7 8	6 7	8 2	6 0	8 0	6 9	102 9	14 10
4	Cross Sht.-horn	Aged	Jan. 29	973	9 8	6 6	8 14	6 12	11 12	7 6	9 4	6 8	8 0	5 10	8 11	0 3	8 6	5 1	106 9	15 7
5	Cross Sht.-horn	6	Nov. 17	1,190	7 6	6 4	6 8	6 6	8 14	6 8	7 6	5 0	7 0	5 1	6 13	5 0	6 10	4 13	88 9	12 10
6	Cross Sht.-horn	Aged	Jan. 13	1,150	11 0	7 12	11 4	8 10	13 0	8 10	11 2	7 12	10 8	8 10	11 2	7 13	10 10	7 8	135 11	19 6
7	Cross Sht.-horn	6	May 2	1,106	14 0	11 11	13 0	17 8	17 12	10 7	13 1	12 6	13 10	11 3	15 9	11 0	15 0	11 0	190 1	27 2
8	Cross Ayrshire	3	Apr. 13	850	11 12	8 4	11 13	8 1	13 12	7 7	13 0	7 9	10 0	8 1	11 7	7 5	10 4	7 8	135 14	19 7
9	Cross Sht.-horn	Aged	Feb. 16	1,232	10 6	7 4	9 12	8 4	11 4	8 14	10 10	7 13	9 0	7 14	10 3	8 4	10 14	7 4	127 10	18 4
10	Ayrshire -	6	Apr. 3	900	15 8	10 6	14 13	10 2	17 8	9 13	14 6	10 2	14 2	10 6	14 6	10 0	14 5	10 2	176 3	25 3
11	Guernsey -	4	Mar. 30	884	10 9	8 7	11 14	8 9	13 8	7 8	10 14	8 2	9 12	8 2	10 4	8 11	9 14	7 10	128 3	18 0
12	Cross Sht.-horn	7	Nov. 16	1,146	13 8	9 1	13 6	7 1	14 12	8 1	13 14	6 6	9 10	7 14	11 6	6 6	11 13	7 9	140 6	20 5

																			days.	per day.

Three Cows.—Unsewaged Grass.

Food consumed.																				
Grass	From which Field, Plot, and Crop.				*		Ten-acre, Plot 0,† Crop 2		Ten-acre, Plot 0,† Crop 2.		Ten-acre, Plot 0,† Crop 2.		—		*		Ten-acre, Plot 0,† Crop 2.		—	—
					tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
	Quantities weighed				0 5 1 24		0 5 1 7		0 3 3 10		0 3 3 11		—		0 3 0 17		0 5 1 4		1 4 3 17	0 1 0 21
Oilcake (equal parts linseed and rape cake)					0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 0 12		0 0 3 0	0 0 0 4

Yield of Milk, &c. Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Mar 20	1,066	13 8	10 0	13 14	10 4	15 14	10 11	14 1	8 1	13 3	9 6	13 12	10 11	15 0	10 1	169 0	24 1
2	Cross Sht.-horn	7	Dec. 25	1,190	6 4	4 1	6 2	6 1	3 8	5 10	5 6	5 12	5 0	5 7	5 10	6 15	6 0	5 1	78 13	11 4
3	Cross Sht.-horn	Aged	Feb. 21	1,020	14 6	10 0	14 12	10 0	15 0	12 0	12 2	10 8	12 1	6 7	10 10	10 1	15 4	10 5	172 6	24 10
	Totals	-		3,276	34 2	24 1	34 12	26 5	30 6	28 5	31 9	24 5	30 4	21 4	30 0	27 14	36 4	25 5	419 13	—
	Means	-		1,092	11 6	8 0	11 9	8 13	12 2	9 7	10 9	8 2	10 1	8 1	12 0	9 5	13 1	8 7	139 15	20 0

Twelve Cows.—Sewaged Grass.

Food consumed.																				
Grass	From which Field, Plot, and Crop.				Ten-acre, Plot 3, Crop 3.		Ten-acre, Plots 00† and 3, Crop 3.		*		*		Five-acre, Plot 3, Crop 3.		Five-acre, Plot 3, Crop 3.		Five-acre, Plot 3, Crop 3.		—	—
					tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
	Quantities weighed				0 15 1 7		0 19 2 16		0 8 3 8		0 8 3 8		0 15 1 0		0 17 0 14		0 16 2 20		5 1 2 26	0 1 0 24
Oilcake (equal parts linseed and rape cake)					0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 0 1 20		0 3 0 0	0 0 0 4

Yield of Milk, &c. Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Nov. 18	1,270	11 1	8 2	10 8	7 7	10 0	8 7	10 14	7 3	10 11	7 13	10 14	8 2	10 5	7 10	129 1	18 7
2	Cross Sht.-horn	8	Feb. 2	1,217	6 7	5 6	7 2	6 1	6 8	6 4	7 4	5 8	7 6	5 1	7 6	5 4	7 0	5 8	87 1	12 7
3	Cross Sht.-horn	6	Dec. 1	1,258	7 13	5 7	7 7	5 2	7 3	5 11	7 10	3 3	7 1	5 10	7 9	6 12	6 8	5 6	89 6	12 12
4	Cross Sht.-horn	Aged	Jan 28	973	8 7	6 9	8 4	6 9	6 1	5 0	9 8	5 8	8 11	5 8	8 0	5 6	8 0	5 11	97 13	14 0
5	Cross Sht.-horn	6	Nov. 17	1,199	7 4	5 0	6 0	4 10	6 2	5 4	6 7	5 0	6 3	4 14	6 6	3 2	6 11	5 3	80 2	11 7
6	Cross Sht.-horn	Aged	Jan. 13	1,150	11 12	7 8	11 6	7 0	10 12	8 6	10 9	7 3	10 12	7 12	13 6	8 0	11 7	9 0	134 15	19 4
7	Cross Sht.-horn	6	May 2	1,106	14 4	11 7	14 15	10 9	16 2	10 15	14 10	9 5	14 4	11 6	16 1	10 5	15 4	11 0	179 5	25 10
8	Cross Ayrshire	3	Apr. 13	850	10 4	7 7	10 8	7 3	11 1	7 7	11 10	6 4	10 1	7 10	11 11	7 8	11 2	7 6	127 2	18 3
9	Cross Sht.-horn	Aged	Feb. 16	1,232	8 8	9 0	9 6	7 1	9 1	8 1	10 4	8 13	10 8	7 6	10 8	7 9	11 10	6 7	124 2	17 12
10	Ayrshire	6	Apr. 3	900	14 0	9 9	12 8	10 1	13 8	9 11	14 8	9 0	13 4	9 7	13 4	9 4	15 0	9 10	162 10	23 4
11	Guernsey	4	Mar. 30	834	10 2	7 11	11 0	7 2	11 0	8 1	10 8	7 0	11 4	7 8	11 10	8 2	12 4	7 13	131 0	18 11
12	Cross Sht.-horn	7	Nov. 16	1,146	12 8	8 8	12 10	8 4	10 8	6 6	10 0	7 0	10 0	6 12	10 11	8 3	10 3	6 8	127 5	18 3
	Total	-		13,275	128 0	90 14	121 10	85 1	118 14	88 11	123 15	83 6	120 1	86 11	127 6	88 0	125 6	87 1	1,469 14	—
	Means	-		1,106	10 3	7 9	10 2	7 3	9 15	7 6	10 5	6 15	10 0	7 4	10 10	7 6	10 7	7 4	122 8	17 8

* Not experimental.

† Unmeasured land; designated Plot 0 when unsewaged, and Plot 00 when sewaged.

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—September 26 to October 2.

THREE COWS.—UNSEWAGED GRASS.

Food consumed.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	..	Ten-acre, Plot 0*, Crop 2.	Ten-acre, Plot 0*, Crop 2.	Ten-acre, Plot 0*, Crop 2.	Ten-acre, Plot 0*, Crop 3.	Ten-acre, Plot 0*, Crop 3.	Ten-acre, Plot 0*, Crop 3.	—	—
	tons. cwts. qrs. lbs.	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*
Grass: Quantities weighed	—	0 3 1 12	0 4 0 19	0 4 0 19	0 3 1 10	0 3 0 22	0 3 1 12	1 1 2 10	0 1 0 3
Oilcake (3 parts linseed and 2 parts rape cake)	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 0 3 21	0 0 0 5

Cows, Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). *lbs.*	Friday A.M. *lbs. ozs.*	Friday P.M. *lbs. ozs.*	Saturday A.M. *lbs. ozs.*	Saturday P.M. *lbs. ozs.*	Sunday A.M. *lbs. ozs.*	Sunday P.M. *lbs. ozs.*	Monday A.M. *lbs. ozs.*	Monday P.M. *lbs. ozs.*	Tuesday A.M. *lbs. ozs.*	Tuesday P.M. *lbs. ozs.*	Wednesday A.M. *lbs. ozs.*	Wednesday P.M. *lbs. ozs.*	Thursday A.M. *lbs. ozs.*	Thursday P.M. *lbs. ozs.*	Total in 7 days. *lbs. ozs.*	Per head per day. *lbs. ozs.*
	Yield of Milk, &c.																			
1	Cross Sht.-horn	6	Mar. 20	1,066	14 0	9 8	14 0	9 4	14 3	8 3	12 4	10 6	14 0	9 12	14 8	9 10	14 0	9 3	162 13	23 4
2	Cross Sht.-horn	7	Dec. 25	1,190	5 6	5 8	3 8	5 12	3 10	5 2	2 2	4 2	2 8	3 11	2 6	4 0	2 0	2 0	51 11	7 6
3	Cross Sht.-horn	Aged	Feb. 28	1,020	14 12	10 14	15 4	10 7	14 7	0 12	12 2	12 2	14 2	10 15	15 6	9 12	16 2	9 7	175 8	25 1
	Totals -			3,276	34 2	25 14	32 12	25 7	32 4	23 1	26 8	26 10	30 10	24 6	32 4	23 6	32 2	20 10	390 0	—
	Means -			1,092	11 6	8 10	10 15	8 8	10 12	7 11	8 13	8 14	10 3	8 2	10 12	7 13	10 11	6 14	130 0	18 9

TWELVE COWS.—SEWAGED GRASS.

Food consumed.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	Five-acre, Plot 3, Crop 3.	Five-acre, Plot 3, Crop 3.	Five-acre, Plot 3, Crop 3.	Five-acre, Plot 3, Crop 3,	†	Ten-acre, Plot 2, Crop 3.	Ten-acre, Plot 2, Crop 3.	—	—
	tons. cwts. qrs. lbs.	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*	*tons. cwts. qrs. lbs.*
Grass: Quantities weighed	1 0 2 5	0 17 0 23	0 16 3 7	0 16 3 3	0 16 0 20	0 15 1 25	0 12 2 9	5 14 2 8	0 1 1 13
Oilcake (3 parts linseed and 2 parts rape cake)	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 3 3 0	0 0 0 5

Cows, Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). *lbs.*	Friday A.M. *lbs. ozs.*	Friday P.M. *lbs. ozs.*	Saturday A.M. *lbs. ozs.*	Saturday P.M. *lbs. ozs.*	Sunday A.M. *lbs. ozs.*	Sunday P.M. *lbs. ozs.*	Monday A.M. *lbs. ozs.*	Monday P.M. *lbs. ozs.*	Tuesday A.M. *lbs. ozs.*	Tuesday P.M. *lbs. ozs.*	Wednesday A.M. *lbs. ozs.*	Wednesday P.M. *lbs. ozs.*	Thursday A.M. *lbs. ozs.*	Thursday P.M. *lbs. ozs.*	Total in 7 days. *lbs. ozs.*	Per head per day. *lbs. ozs.*
	Yield of Milk, &c.																			
1	Cross Sht.-horn	6	Nov. 18	1,270	10 2	7 11	10 14	7 8	11 0	7 6	10 0	7 4	10 12	8 0	10 14	8 0	11 13	7 11	129 5	18 8
2	Cross Sht.-horn	8	Feb. 2	1,267	6 8	5 10	6 9	5 6	7 1	5 3	7 0	4 12	6 0	4 13	6 13	4 15	6 11	5 0	82 5	11 12
3	Cross Sht.-horn	6	Dec. 1	1,288	7 9	4 11	7 6	5 6	7 8	5 10	7 2	4 13	7 0	4 14	6 10	4 3	6 0	4 4	82 14	11 13
4	Cross Sht.-horn	Aged	Jan. 26	973	7 14	6 1	7 11	6 6	7 10	6 12	7 4	5 10	7 4	5 4	8 6	5 14	8 4	5 8	95 12	13 11
5	Cross Sht.-horn	6	Nov. 17	1,199	6 5	5 8	6 3	4 12	0 12	4 13	6 3	4 10	5 0	4 15	5 0	4 7	5 6	4 8	74 12	10 11
6	Cross Sht.-horn	Aged	Jan. 13	1,150	11 6	9 2	11 12	8 6	11 10	8 3	10 1	7 10	10 4	7 15	11 0	7 12	10 4	8 6	133 11	19 2
7	Cross Sht.-horn	6	May 2	1,100	15 2	11 0	15 6	10 4	14 10	10 13	12 10	9 4	13 1	9 12	14 5	10 10	13 12	9 4	160 11	24 4
8	Cross Ayrshire	3	Apr. 15	850	11 6	8 1	11 14	7 11	12 1	7 0	12 1	6 2	11 0	7 4	11 10	7 15	11 5	0 15	132 3	18 14
9	Cross Sht.-horn	Aged	Feb. 16	1,232	10 7	7 1	11 12	7 8	11 6	7 4	10 4	7 1	10 8	7 0	10 2	7 12	10 12	6 7	125 4	17 14
10	Ayrshire -	6	Apr. 3	960	14 6	7 9	15 4	0 14	16 0	9 2	14 6	8 12	13 0	10 3	14 6	9 4	13 8	9 1	104 10	23 6
11	Guernsey -	4	Mar. 30	834	11 10	8 6	12 4	8 4	12 2	7 7	10 8	7 4	10 12	7 8	11 2	8 3	10 6	8 2	134 0	19 2
12	Cross Sht.-horn	7	Nov. 16	1,140	10 8	7 1	11 0	7 6	11 8	7 3	10 14	8 14	10 10	8 3	10 5	6 14	10 9	6 15	127 7	18 3

THREE COWS.—UNSEWAGED GRASS.

Cows No.	Breed	Years old	Dates of Calving	Weights (Sept. 18). lbs	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
Grass: From which Field, Plot, and Crop					Ten-acre, Plot 0,* Crop 3.		Ten-acre, Plot 0,* Crop 2.		Ten-acre, Plot 0,* Crop 2.		Ten-acre, Plot 0,* Crop 2.		†		†		†		—	—
Grass: Quantities weighed (tons. cwts. qrs. lbs.)					0 2 1 9		0 1 3 15		0 1 2 24		0 1 2 24		0 3 3 23		0 3 3 17		0 2 3 0		0 18 1 5	0 0 3 14
Oilcake (3 parts linseed and 2 parts rape cake) (tons. cwts. qrs. lbs.)					0 0 0 15		0 0 0 15		0 0 0 16		0 0 0 15		0 0 0 15		0 0 0 16		0 0 0 15		0 0 3 21	0 0 0 5
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Mar. 20	1,060	14 2	9 11	13 8	9 13	13 2	9 6	14 10	9 5	13 2	10 0	13 8	9 14	13 3	9 4	102 8	23 3
2	Cross Sht.-horn	7	Dec. 25	1,190	3 4	3 6	3 6	2 7	9 12	2 5	1 12	3 15	1 10	3 8	1 12	2 8	2 4	2 0	58 13	5 4
3	Cross Sht.-horn	Aged	Feb. 26	1,026	14 8	9 15	15 2	10 4	10 6	10 7	13 8	9 7	14 12	11 2	14 4	10 11	13 4	9 15	167 9	23 15
		Totals	-	3,276	31 14	23 0	32 0	22 8	28 4	22 2	29 14	22 11	20 8	21 10	29 8	23 1	28 11	21 3	328 14	—
		Means	-	1,092	10 10	7 11	10 11	7 8	8 12	7 6	9 15	7 9	9 14	8 3	9 15	7 11	9 9	7 1	122 5	17 8

TWELVE COWS.—SEWAGED GRASS.

Cows No.	Breed	Years old	Dates of Calving	Weights (Sept. 18). lbs	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
Grass: From which Field, Plot, and Crop					Ten-acre, Plot 2, Crop 3.		Ten-acre, Plot 2, Crop 3.		Ten acre, Plot 2, Crop 3 & Plot 4, Crop 4.		Ten-acre, Plot 2, Crop 3 & Plot 4, Crop 4		†		†		†		—	—
Grass: Quantities weighed (tons. cwts. qrs. lbs.)					0 14 2 5		0 13 2 27		0 13 3 0		0 13 3 1		0 19 0 21		0 16 2 25		0 13 3 7		5 5 2 2	0 1 1 1
Oilcake (3 parts linseed and 2 parts rape cake) (tons. cwts. qrs. lbs.)					0 0 2 4		0 0 2 4		0 0 2 4		0 0 2 4		0 0 2 4		0 0 2 4		0 0 2 4		0 3 3 0	0 0 0 5
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross Sht.-horn	6	Nov. 18	1,270	10 10	8 0	11 2	7 6	11 0	7 0	10 11	6 4	10 7	7 2	10 11	7 8	10 13	7 0	125 10	17 15
2	Cross Sht.-horn	8	Feb. 3	1,267	6 9	5 0	5 12	5 6	8 1	4 13	6 10	5 2	6 2	5 3	7 1	5 4	7 3	6 0	84 4	12 1
3‡	Cross Sht.-horn	6	Dec. 1	1,288	6 1	4 6	6 0	3 12	5 2	3 7	4 0	2 7	3 1	..	..	1 12	2 8	1 15	44 5	6 5
4	Cross Sht.-horn	Aged	Jan 26	973	7 6	6 4	7 11	6 2	8 6	6 0	7 6	5 2	7 0	5 4	7 3	4 8	7 0	4 10	90 9	12 15
5	Cross Sht.-horn	8	Nov. 17	1,190	5 11	5 8	6 10	4 10	6 4	4 6	6 0	4 7	6 2	4 9	5 11	4 8	5 7	4 3	72 13	10 6
6	Cross Sht.-horn	Aged	Jan 15	1,160	10 11	8 0	11 1	7 10	11 8	7 3	10 11	7 11	10 12	8 5	10 13	8 4	10 11	7 10	131 1	18 12
7	Cross Sht.-horn	8	May 2	1,106	14 0	10 12	10 0	15 8	11 2	9 0	14 10	9 9	13 8	10 7	13 11	10 2	13 9	8 9	162 7	23 3
8	Cross Ayrshire	3	Apr. 13	850	10 12	7 6	11 8	7 9	11 2	7 8	11 8	8 0	10 13	7 12	11 7	7 1	10 7	0 13	128 1	18 5
9	Cross Sht.-horn	Aged	Feb. 16	1,212	10 0	7 10	10 4	7 2	10 8	6 14	10 11	7 2	9 12	7 9	10 0	6 13	10 4	5 10	120 3	17 3
10	Ayrshire	6	Apr. 3	960	13 10	9 0	13 13	9 4	11 12	8 11	13 11	8 11	13 12	9 6	14 8	8 11	13 4	8 10	150 10	22 13
11	Guernsey	4	Mar. 30	894	11 3	7 6	11 2	8 5	12 8	7 8	11 2	7 5	10 9	9 0	10 8	7 6	10 2	7 15	131 15	18 14
12	Cross Sht.-horn	7	Nov. 16	1,136	10 12	7 10	10 14	6 4	10 12	6 8	10 1	6 10	9 14	7 1	10 12	7 14	10 4	7 10	122 14	17 9
		Totals	-	13,275	117 4	88 9	116 0	80 14	121 1	79 2	117 2	76 15	112 4	81 10	112 5	79 12	111 8	75 11	1,573 14	—
		Means	-	1,106	9 12	7 3	9 11	7 4	10 1	6 9	9 12	6 7	9 6	6 13	9 6	6 10	9 5	6 5	114 8	16 8

* Unmeasured land, designated Plot 0 when unsewaged. † Not experimental. ‡ This cow calved again Oct. 7, 1862.

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—October 10 to October 16.

THREE COWS.—UNSEWAGED GRASS.

Food consumed (tons. cwts. qrs. lbs.):

—	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	•	•	•	•	Ten-acre, Plot 0†, Crop 2.	—	•	—	—
Grass: Quantities weighed	0 4 0 0	0 3 1 10	0 3 0 27	0 3 1 0	0 4 0 20	—	0 4 0 0	1 2 0 1	0 1 0 5
Oilcake (3 parts linseed and 2 parts rape cake)	0 0 0 13	0 0 0 16	0 0 0 15	0 0 0 15	0 0 0 16	0 0 0 15	0 0 0 16	0 0 3 21	0 0 0 5

Yield of Milk, &c. (lbs. ozs.):

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (Oct. 10) lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Mar. 20	1,059	13 4	9 0	13 1	8 10	12 2	8 4	15 0	8 6	13 12	5 5	13 0	7 14	13 2	8 3	148 15	21 4
2	Cross Sht.-horn	7	Dec. 25	1,219	3 12	2 1	2 6	2 2	2 0	2 9	1 12	1 6	1 14	2 15	1 11	3 8	1 8	2 9	31 10	4 8
3	Cross Sht.-horn	Aged	Feb. 26	1,058	13 8	10 8	13 11	9 4	13 8	11 8	13 0	10 6	13 0	10 1	13 1	8 6	13 11	8 15	102 7	28 3
			Totals -	3,333	29 6	21 9	23 2	20 0	27 10	22 5	20 12	20 2	23 10	21 5	27 12	10 14	27 5	19 4	343 0	—
			Means -	1,112	9 13	7 3	9 6	6 11	9 3	7 7	9 14	6 11	9 9	7 2	9 4	6 9	9 2	6 7	114 5	16 5

TWELVE COWS.—SEWAGED GRASS.

Food consumed (tons. cwts. qrs. lbs.):

—	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	•	Ten-acre, Plot 4, Crop 4.	•	•	Ten-acre, Plot 4, Crop 4.	Ten-acre, Plot 3, Crop 4.	Ten-acre, Plot 3, Crop 4.	—	—
Grass: Quantities weighed	0 14 1 0	1 5 1 9	0 15 3 26	0 15 3 26	0 17 0 5	0 13 1 0	0 19 1 0	6 0 0 10	0 1 1 20
Oilcake (3 parts linseed and 2 parts rape cake)	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 3 3 0	0 0 0 3

Yield of Milk, &c. (lbs. ozs.):

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (Oct. 10) lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Nov. 18	1,298	10 4	7 15	10 11	8 2	10 7	6 12	10 4	7 7	11 6	7 14	11 1	7 3	10 13	7 5	127 10	18 4
2	Cross Sht.-horn	8	Feb. 2	1,270	6 8	5 3	6 10	4 12	6 11	5 0	6 2	4 14	6 14	5 0	6 12	5 1	5 13	4 7	77 11	11 2
3	Cross Sht.-horn	6	Dec. 1	1,223	3 14	3 8	4 14	3 0	5 0	4 4	5 14	3 9	6 14	3 9	7 1	4 0	7 0	4 7	68 14	9 9
4	Cross Sht.-horn	Aged	Jan. 26	930	6 9	5 3	6 11	5 2	6 5	4 10	6 3	4 14	6 0	4 12	6 14	3 13	5 12	4 8	76 3	10 14
5	Cross Sht.-horn	6	Nov. 17	1,214	5 0	4 11	5 2	4 6	5 3	4 12	6 11	4 1	6 2	4 8	6 5	4 4	4 11	4 4	67 0	9 9
6	Cross Sht.-horn	Aged	Jan. 13	1,160	10 0	8 0	10 1	8 15	10 4	7 14	10 4	7 10	10 0	7 12	10 14	7 3	10 10	7 3	127 9	18 4
7	Cross Sht.-horn	6	May 2	1,101	13 1	9 14	14 11	10 9	13 13	10 12	13 8	9 12	12 8	10 4	13 0	9 0	12 6	9 8	162 14	23 4
8	Cross Ayrshire	3	Apr. 13	869	10 12	7 6	10 3	8 4	11 2	7 8	12 4	6 9	10 2	7 9	11 8	7 0	11 0	7 10	128 13	18 6
9	Cross Sht.-horn	Aged	Feb. 16	1,234	7 4	7 4	10 0	8 11	10 4	7 6	10 0	6 15	10 6	7 4	10 9	6 14	10 8	7 12	118 9	16 15
10	Ayrshire	6	Apr. 3	976	13 0	9 8	13 0	9 9	12 8	8 12	14 2	7 13	12 6	9 2	13 6	8 7	12 0	8 9	152 0	21 11
11	Guernsey	4	Mar. 30	830	11 0	7 15	11 0	8 0	11 0	7 4	11 6	6 8	10 2	8 8	11 2	7 13	10 14	7 13	120 15	18 0
12	Cross Sht.-horn	7	Nov. 16	1,008	10 14	8 15	10 12	7 11	11 1	7 8	11 4	7 10	11 7	7 12	11 4	7 10	11 0	8 14	133 10	19 1

Third Season, 1883; 7 days.—April 28 to May 4.

Five Cows.*—Unsewaged Meadow Grass.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop				Rye, Plot 2, Crop 1.		Rye, Plot 1, Crop 1.		Rye, Plot 1, Crop 1.		Rye, Plot 1, Crop 1.		Rye, Plot 1, Crop 1.		Rye, Plot 1, Crop 1.		Rye, Plot 1, Crop 1.		—	—
	Quantities weighed (tons, cwts, qrs, lbs.)				0 3 0 0		0 3 2 0		0 7 0 0		0 7 2 0		0 6 0 0		0 5 0 6		0 5 0 7		1 15 0 15	0 1 0 0
Yield of Milk, &c. Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (April 27) lbs.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	lbs. oz.	lbs. oz.
1	Cross short-horn	Aged	Mar. 1	1,042	17 0	12 8	18 10	11 9	16 2	11 4	14 2	11 8	15 3	13 0	17 0	10 0	19 4	12 8	207 12	29 11
2	Cross short-horn	8	Feb. 15	1,117	20 3	15 8	18 4	16 5	19 0	12 12	18 0	15 4	16 11	15 8	17 8	16 8	20 6	14 4	213 14	[illegible]
3	Cross short-horn	3	April 13	748	17 10	12 14	16 4	10 12	13 10	15 1	16 0	11 3	16 12	12 2	18 2	12 1	18 6	9 3	200 10	28 10
4	Cross short-horn	7	Feb. 17	1,089	18 6	13 8	17 8	12 1	15 4	14 12	15 1	11 10	13 11	11 14	9 11	6 0	11 10	6 0	178 0	25 7
5	Cross short-horn	7	April 17	1,056	16 8	13 14	16 0	17 4	17 1	17 3	10 0	11 14	18 8	12 11	20 2	15 0	19 8	15 11	210 0	29 14
			Totals	5,052	80 11	68 4	80 10	65 13	81 1	74 0	80 9	61 9	81 0	65 9	82 0	59 4	80 6	58 6	1,053 4	—
			Means	1,010	17 13	13 10	17 3	13 9	16 4	14 13	17 3	12 5	16 3	13 2	16 6	11 14	17 14	11 14	210 7	30 1

Ten Cows.—Sewaged Meadow Grass.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop				Five-acre, Plot 4, Crop 1.		Five-acre, Plot 4, Crop 1.		—		Ten acre, Plot 4, Crop 1.		Five-acre, Plot 4, Crop 1.		Five-acre, Plot 4, Crop 1.		Five-acre, Plot 4, Crop 1.		—	—
	Quantities weighed (tons, cwts, qrs, lbs.)				0 17 1 25		0 17 1 17		—		0 6 3 25		0 12 1 25		0 8 0 3		0 8 0 3		3 10 1 8	0 1 0 1
1	Cross short-horn	Aged	Mar. 10	1,061	20 6	14 13	18 12	15 13	16 12	15 12	16 8	15 8	17 1	15 12	18 8	18 0	16 4	13 5	235 2	33 9
2	Cross short-horn	Aged	April 7	1,088	21 12	18 10	22 1	14 12	21 4	14 4	21 6	13 4	20 10	16 8	25 0	15 10	23 2	14 10	263 5	37 10
3	Cross short-horn	6	Feb. 20	1,030	17 11	14 0	18 0	15 14	16 6	12 11	15 12	13 2	16 2	14 3	17 0	13 7	18 1	13 9	214 7	30 10
4	Cross short-horn	7	Feb. 13	1,051	17 12	12 11	15 10	12 10	11 0	12 10	14 14	11 4	14 0	12 0	16 3	12 2	17 6	12 2	195 8	27 14
5	Ayrshire	8	Feb. 23	1,042	16 8	15 12	16 3	10 12	14 10	9 11	15 6	10 11	14 4	11 0	13 0	13 6	15 4	11 0	183 9	26 3
6	Cross short-horn	6	April 14	890	19 10	10 8	18 6	11 10	20 1	12 2	15 8	14 0	17 6	10 10	18 14	13 0	18 6	12 4	213 5	30 5
7	Mongrel	Aged	April 12	888	19 0	10 12	18 0	12 1	15 0	9 5	15 2	9 9	15 11	10 8	17 8	11 4	17 4	11 0	191 0	27 7
8	Cross short-horn	6	April 16	920	11 6	11 1	12 3	9 11	10 4	10 1	13 6	11 0	12 4	10 14	12 0	11 1	11 10	12 8	150 3	21 12
9	Cross short-horn	7	April 12	901	18 0	11 12	10 2	15 7	17 2	13 8	16 7	12 6	18 1	14 7	21 10	14 7	21 8	14 8	223 10	32 4
10	Half short-horn	Aged	Oct. 30	1,220	13 5	12 12	12 11	9 3	12 9	8 8	13 0	11 1	12 0	7 13	13 0	12 2	14 1	11 0	164 13	23 9
			Totals	10,012	177 4	131 6	171 0	128 6	158 0	118 8	157 3	121 7	157 7	123 11	173 0	134 9	174 14	125 12	2,047 9	—
			Means	1,001	17 11	13 2	17 1	12 6	15 13	11 14	15 12	12 2	15 12	12 0	17 5	13 7	17 8	12 9	204 12	29 4

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop				Rye, Plot 2, Crop 1.		Rye, Plot 1, Crop 1.		Rye, Plot 1, Crop 1.		Rye, Plot 1, Crop 1.		Rye, Plot 1, Crop 1.		Rye, Plot 1, Crop 1.		Rye, Plot 1, Crop 1.		—	—
	Quantities weighed (tons, cwts, qrs, lbs.)				0 3 0 0		0 6 1 0		0 6 3 7		0 7 2 20		0 5 1 0		0 3 0 6		0 5 0 6		1 15 0 11	0 1 0 0
1	Cross short-horn	Aged	April 20	1,000	23 6	15 5	25 1	17 0	24 4	20 10	23 8	16 9	21 13	18 4	20 6	15 11	27 0	15 0	246 6	40 15
2	Ayrshire	6	Mar. 15	874	23 8	17 2	22 10	16 14	23 3	16 1	21 12	14 1	21 8	14 5	21 0	13 6	21 3	15 6	252 0	37 7
3†	Cross short-horn	Aged	May 1	1,050	15 10	9 3	27 6	16 8	27 4	20 14	22 10	10 14	..	..	..	..	..	..	150 5	30 14
4	Cross short-horn	Aged	April 15	1,165	24 6	17 14	21 9	19 9	22 10	19 6	22 4	16 14	23 1	14 12	27 0	15 8	25 10	13 13	280 14	40 2
5	Half short-horn	4	Feb. 8	1,114	15 9	15 13	20 4	12 0	10 0	11 9	18 12	11 2	18 0	10 10	17 12	10 2	18 8	11 0	210 1	30
			Totals	5,230	103 7	75 3	116 7	81 15	115 6	88 10	108 14	77 8	84 6	57 15	86 4	52 11	94 13	55 4	1,059 8	—
			Means	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table X.—continued.

Detailed Record of Food consumed, and Milk yielded, by Cows fed on Unsewaged and Sewaged Meadow Grass, and Italian Rye Grass (without Oilcake).

Third Season, 1863; 7 days.—May 5 to May 11.

Five Cows.*—Unsewaged Meadow Grass.

	Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (Apr. 27). lbs.	Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop					Rye, Plot 1, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		—	—
	Quantities weighed (tons. cwts. qrs. lbs.)					0 6 2 9		0 9 0 16		0 4 0 0		0 5 2 20		0 6 1 16		0 5 2 7		0 5 2 6		1 16 3 11	0 1 0 19
Yield of Milk, &c.						lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
	1	Cross short-horn	Aged	Mar. 1	1,012	16 4	11 13	17 6	10 4	17 4	10 0	17 13	10 0	16 9	10 4	16 14	10 11	17 12	11 4	240 3	28 10
	2	Cross short-horn	6	Feb. 15	1,117	20 4	12 8	18 2	13 8	18 8	11 8	20 1	12 4	19 1	12 3	18 6	12 15	19 6	15 4	221 14	31 11
	3	Cross short-horn	3	April 12	746	17 12	11 10	17 12	10 8	17 4	11 9	16 10	11 1	17 0	10 10	15 6	9 12	15 14	10 0	192 13	27 0
	4	Cross short-horn	7	Feb. 17	1,080	9 6	9 0	11 1	9 10	10 10	9 7	10 0	5 15	12 4	6 11	12 0	3 15	12 10	10 1	134 12	19 4
	5	Cross short-horn	7	April 17	1,136	16 4	13 5	20 2	12 11	21 0	13 4	20 8	11 13	20 11	13 0	21 4	13 4	21 6	12 14	231 6	33 1
				Totals	5,036	82 0	58 6	84 7	56 9	84 10	55 12	85 0	51 1	87 8	54 12	85 14	50 9	87 0	57 7	980 15	—
				Means	1,010	16 6	11 11	16 14	11 5	16 15	11 2	17 0	10 4	17 8	10 15	17 3	10 2	17 6	11 8	196 3	28 0

Ten Cows.—Sewaged Meadow Grass.

	Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (Apr. 27). lbs.	Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	Total in 7 days.	Per head per day.
Grass consumed	From which Field, Plot, and Crop					Five-acre, Plot 4, Crop 1		Five acre, Plot 4, Crop 1.		Five-acre, Plot 4, Crop 1.		—		Ten acre, Plot 4. Crop 1.		Five-acre, Plot 4, Crop 1.		Five-acre, Plot 4, Crop 1			—
	Quantities weighed (tons. cwts. qrs. lbs.)					0 15 1 19		0 12 0 6		0 13 3 22		—		0 17 0 10		0 9 0 17		0 9 0 18		3 16 2 6	0 1 0 16
Yield of Milk, &c.	1	Cross short-horn	Aged	Mar. 10	1,064	18 0	15 1	20 10	16 1	19 6	14 3	21 4	13 6	19 8	15 14	20 0	15 8	19 4	13 1	243 2	34 12
	2	Cross short-horn	Aged	April 7	1,036	24 2	17 0	25 3	18 8	25 4	18 0	25 5	18 8	26 12	18 7	24 7	18 5	26 3	17 2	304 13	43 9
	3	Cross short horn	6	Feb. 20	1,030	17 4	13 11	16 6	11 10	16 6	14 9	17 3	13 4	18 10	13 9	18 0	14 1	20 8	12 13	218 0	31 2
	4	Cross short-horn	7	Feb. 15	1,036	17 9	12 8	18 0	12 6	16 14	13 0	17 14	12 10	17 0	12 4	17 2	13 12	15 12	12 0	210 13	30 2
	5	Ayrshire	8	Feb. 22	1,092	15 6	12 1	17 4	12 0	16 11	11 8	17 4	10 10	16 0	11 6	17 10	11 9	16 10	10 4	196 14	28 2
	6	Cross short-horn	6	April 14	980	18 8	14 7	20 12	14 2	20 9	14 6	19 2	13 11	18 11	13 13	21 6	14 0	12 13	12 8	236 14	33 13
	7	Mongrel	Aged	April 12	804	16 0	11 6	17 2	11 2	15 3	10 13	14 12	10 4	16 6	11 1	16 6	12 0	14 0	10 10	187 1	26 11
	8	Cross short-horn	6	April 16	980	13 1	6 8	9 2	7 1	14 1	11 6	17 0	12 14	16 7	11 2	16 1	10 12	17 8	11 2	173 12	24 13
	9	Cross short-horn	7	April 18	906	19 12	16 0	21 15	14 1	20 1	14 2	20 4	13 10	20 10	14 5	20 2	15 11	20 0	14 11	245 4	35 1
	10	Half short horn	Aged	Oct. 20	1,130	13 6	9 12	13 2	10 5	13 2	10 1	13 2	10 14	12 0	10 11	13 0	10 6	13 10	9 11	163 3	23 3
				Totals	10,042	172 0	129 6	170 9	125 6	177 9	139 0	183 5	131 6	182 9	133 10	185 2	135 14	183 15	125 0	2,178 11	—
				Means	1,004	17 3	12 13	16 0	12 9	17 12	13 3	16 5	13 2	15 4	13 4	16 13	13 10	15 6	12 8	217 14	31 2

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

	Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (Apr. 27). lbs.	Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop					Rye, Plot 1, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		—	—
	Quantities weighed (tons. cwts. qrs. lbs.)					0 7 3 13		0 9 2 0		0 4 1 8		0 6 1 9		0 6 0 10		0 8 1 27		0 8 1 20		2 1 0 7	0 1 0 19
Yield of	1	Cross short-horn	Aged	April 20	1,088	20 8	17 10	26 0	15 2	25 14	18 1	25 9	16 0	27 4	16 6	27 8	16 7	24 10	20 6	301 11	43 2
	2	Ayrshire	6	Mar. 15	974	23 9	16 1	24 0	14 6	22 8	14 0	20 6	14 15	21 3	14 7	21 6	14 1	20 14	14 0	209 1	27 2
	3	Cross short-horn	Aged	May 1	1,021	27 3	16 9	25 6	19 6	23 10	16 1	22 15	15 9	25 0	17 6	25 4	15 6	24 0	10 1	204 6	43 1
	4	Cross short-horn	Aged	April 15	1,185	28 8	14 14	26 0	17 1	25 10	16 14	24 16	15 7	24 8	18 8	26 0	14 11	20 4	14 0	208 8	40 0

																					7 days.	per day.

Five Cows.*—Unsewaged Meadow Grass.

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (April 27) lbs.																
Grass consumed.	From which Field, Plot, and Crop				Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)				0 7 0 0		0 6 3 8		0 5 2 0		0 6 1 0		0 6 2 0		0 5 3 11		0 8 2 10		2 1 1 1	0 1 0 20
Yield of Milk, &c.					A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross short-horn	Aged	Mar. 1	1,043	16 9	11 14	16 12	10 8	17 10	10 8	18 2	11 10	17 4	11 8	17 5	9 6	18 3	9 6	196 12	28 2
2	Cross short horn	6	Feb. 15	1,117	20 0	11 15	16 9	12 0	14 2	18 5	17 10	19 0	16 15	11 8	16 8	11 8	18 9	11 0	210 6	30 1
3	Cross short horn	3	April 18	740	16 0	10 14	17 8	11 0	17 12	10 15	17 15	11 7	16 10	10 12	17 4	10 12	16 2	9 14	198 15	28 2
4	Cross short-horn	7	Feb. 17	1,080	10 1	8 5	11 10	7 13	11 10	9 8	12 6	8 12	13 4	9 5	12 11	7 6	13 11	7 4	145 10	20 8
5	Cross short horn	7	April 17	1,036	20 0	13 3	22 1	15 10	21 8	13 10	22 12	14 6	22 4	13 6	21 0	15 2	22 14	12 6	246 4	35 3
			Totals	5,052	83 9	56 5	86 6	55 3	86 10	57 12	88 13	65 9	86 6	56 7	84 12	53 2	91 12	50 0	998 13	—
			Means	1,010	16 6	11 4	17 5	11 1	17 5	11 9	17 12	11 11	17 4	11 5	16 15	10 7	18 6	10 0	199 12	28 6

Ten Cows.—Sewaged Meadow Grass.

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights lbs.																
Grass consumed.	From which Field, Plot, and Crop				Five-acre, Plot 8, Crop 1.		Five-acre, Plot 8, Crop 1.		Five acre, Plot 8, Crop 1.		Ten-acre, Plot 4, Crop 1		Ten-acre, Plot 4, Crop 1.		Ten-acre, Plot 3, Crop 1.		Ten-acre, Plot 3, Crop 1.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)				0 19 1 12		0 11 3 19		0 14 2 6		0 16 1 6		0 18 2 14		0 7 1 13		0 7 1 19		4 10 1 5	0 1 1 5
1	Cross short-horn	Aged	Mar 10	1,064	19 15	15 6	23 4	14 6	20 0	14 7	20 2	15 15	19 8	15 8	18 8	13 8	19 2	15 7	243 11	34 11
2	Cross short horn	Aged	April 7	1,036	26 0	17 13	26 10	19 4	27 5	15 4	27 1	16 2	27 1	20 4	27 8	16 0	26 2	16 0	313 7	44 12
3	Cross short-horn	6	Feb. 20	1,030	18 4	14 10	20 10	14 0	19 2	14 11	17 2	15 6	18 10	13 15	18 10	14 1	19 0	15 4	229 5	32 12
4	Cross short horn	7	Feb. 15	1,031	16 4	12 10	17 11	12 6	17 6	12 8	17 12	13 1	17 4	13 8	18 6	11 2	16 11	10 14	209 7	29 15
5	Ayrshire	8	Feb. 22	1,003	15 0	11 2	18 14	10 8	17 9	12 0	16 14	12 3	16 2	12 5	16 6	11 1	17 0	9 6	194 8	27 12
6	Cross short-horn	6	April 14	860	20 6	13 0	19 8	13 13	18 13	14 5	21 2	18 15	20 12	16 1	21 14	12 13	20 0	12 6	239 0	34 2
7	Mongrel	Aged	April 12	808	16 6	9 15	16 1	11 6	20 2	12 5	18 13	12 5	10 8	12 5	19 6	10 12	17 4	10 1	206 6	29 8
8	Cross short horn	8	April 15	950	14 8	11 12	14 0	11 4	13 12	11 12	15 0	13 6	12 8	13 1	13 0	11 14	14 0	10 6	178 5	25 7
9	Cross short horn	7	April 13	908	16 0	15 6	20 6	14 1	20 5	13 14	20 12	15 12	20 5	15 3	19 0	14 12	20 8	12 1	240 8	34 6
10	Half short-horn	Aged	Oct. 30	1,320	13 12	9 11	12 8	9 12	13 1	10 14	13 12	11 2	13 0	10 8	13 4	8 12	14 0	8 9	162 9	23 4
			Totals	10,042	178 7	131 7	188 8	130 11	187 6	135 0	188 8	141 3	184 5	142 10	183 1	124 10	186 4	116 2	2,216 0	—
			Means	1,004	17 14	13 2	18 11	13 1	18 12	13 8	18 10	14 2	18 7	14 4	18 5	12 7	18 10	11 10	221 10	31 11

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights lbs.																
Grass consumed.	From which Field, Plot, and Crop				Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1.		Rye, Plot 0†, Crop 1		—	-
	Quantities weighed (*tons. cwts. qrs. lbs.*)				0 7 0 2		0 7 1 0		0 5 2 20		0 8 1 20		0 7 0 0		0 5 0 5		0 8 0 7		2 1 1 24	0 1 0 21
1	Cross short-horn	Aged	April 20	1,086	26 1	17 6	27 2	19 1	26 0	19 5	27 6	21 7	26 12	19 14	26 8	17 8	27 1	16 6	321 15	46 0
2	Ayrshire	6	Mar. 15	874	21 10	15 4	22 5	15 9	22 9	14 9	22 6	15 0	23 3	14 3	21 10	13 12	22 4	13 3	257 7	36 12
3	Cross short-horn	Aged	May 1	1,050	25 8	15 10	25 6	17 10	25 11	16 5	24 6	17 8	23 4	17 8	25 14	16 14	26 9	16 4	295 9	42 4
4	Cross short horn	Aged	April 15	1,185	16 12	10 14	20 0	13 1	20 7	13 4	22 1	13 9	22 0	16 9	22 2	10 7	18 12	11 11	230 9	32 10
5	Half short-horn	4	Feb. 8	1,114	2 6	2 3	2 0	3 6	3 9	2 9	3 8	2 5	3 0	1 6	3 2	1 10	3 9	1 9	36 8	5 3
			Totals	5,259	94 5	61 5	97 6	68 11	100 4	65 6	99 5	69 14	100 3	69 10	99 4	60 3	97 3	59 1	1,142 0	—
			Means	1,052	18 14	12 4	19 8	13 12	20 1	13 1	19 14	13 15	20 0	13 15	19 13	12 1	19 7	11 13	228 6	32 10

* Rye grass was given to these cows until the unsewaged meadow grass was ready for cutting.

† Unmeasured land; designated Plot 0 when unsewaged.

TABLE XIII.—continued.

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1869; 7 days.—August 29 to September 4.

THREE COWS.—UNSEWAGED GRASS.

Food consumed. (tons, cwts, qrs, lbs.)

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	—	—
Grass: Quantities weighed	0 2 2 3½	0 2 1 25½	0 1 2 22½	0 1 2 24	0 2 2 11½	0 3 3 11½	0 3 3 1½	0 18 2 16	0 0 3 15
Oilcake (equal parts linseed and rape cake)	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 3 0	0 0 0 4

Yield of Milk, &c. (lbs. ozs.)

Cows. No.	Breed.	Years old.	Dates of Calving.	Weights (Aug. 21) lbs.	Friday A.M.	Friday P.M.	Saturday A.M.	Saturday P.M.	Sunday A.M.	Sunday P.M.	Monday A.M.	Monday P.M.	Tuesday A.M.	Tuesday P.M.	Wednesday A.M.	Wednesday P.M.	Thursday A.M.	Thursday P.M.	Total in 7 days	Per head per day
1	Cross Sht.-horn	6	Mar. 20	1,078	13 0	11 12	16 0	10 8	15 12	10 1	14 6	9 6	14 4	11 1	13 10	9 14	14 6	10 13	176 12	25 4
2	Cross Sht.-horn	7	Dec. 25	1,170	7 8	3 0	7 14	7 8	6 1	6 10	6 0	7 10	5 10	6 15	6 0	7 10	6 8	6 8	95 15	13 7
3	Cross Sht.-horn	Aged	Feb. 26	1,012	17 0	10 6	16 2	12 0	16 3	10 10	16 3	10 2	16 6	10 4	17 2	11 1	16 0	11 4	190 11	27 4
	Totals			3,258	39 8	27 11	40 0	30 0	38 0	27 5	36 9	27 2	36 4	28 4	36 12	28 9	36 14	28 8	461 8	—
	Means			1,086	13 3	9 4	13 5	10 0	12 11	9 2	12 3	9 1	12 1	9 6	12 4	9 8	12 5	9 8	153 13	23 0

TWELVE COWS.—SEWAGED GRASS.

Food consumed. (tons, cwts, qrs, lbs.)

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	Ten-acre, Plot 4, Crop 3.	Ten-acre, Plot 4, Crop 3.	Ten-acre, Plot 4, Crop 3.	Ten-acre, Plot 4, Crop 3.	Ten-acre, Plot 4, Crop 3.	Ten-acre, Plot 4, Crop 3.	Ten-acre, Plot 4, Crop 3.	—	—
Grass: Quantities weighed	0 18 0 9	0 14 2 5	0 5 0 23	0 5 1 1	0 13 2 14	0 15 2 12	0 13 1 25	4 5 3 5	0 1 0 3
Oilcake (equal parts linseed and rape cake)	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 3 0 0	0 0 0 4

Yield of Milk, &c. (lbs. ozs.)

Cows. No.	Breed.	Years old.	Dates of Calving.	Weights (Aug. 21) lbs.	Friday A.M.	Friday P.M.	Saturday A.M.	Saturday P.M.	Sunday A.M.	Sunday P.M.	Monday A.M.	Monday P.M.	Tuesday A.M.	Tuesday P.M.	Wednesday A.M.	Wednesday P.M.	Thursday A.M.	Thursday P.M.	Total in 7 days	Per head per day
1	Cross Sht.-horn	6	Nov. 18	1,224	11 13	8 7	11 10	6 0	11 11	8 7	11 3	7 12	11 4	8 7	11 13	8 9	11 12	8 10	139 15	19 14
2	Cross Sht.-horn	8	Feb. 8	1,237	8 6	5 8	8 3	5 14	8 4	5 13	7 12	5 14	8 3	6 2	8 13	5 15	8 7	6 2	99 0	14 2
3	Cross Sht.-horn	6	Dec. 1	1,234	10 3	7 0	10 0	6 9	8 0	8 3	8 4	6 4	8 14	7 0	9 6	6 3	9 6	6 10	112 0	16 0
4	Cross Sht.-horn	Aged	Jan. 26	973	10 6	7 0	10 5	6 13	10 0	6 10	9 6	6 8	9 1	6 14	9 6	6 9	9 0	7 5	115 5	16 8
5	Cross Sht.-horn	6	Nov. 17	1,158	9 0	5 10	8 14	6 12	9 0	6 4	7 9	5 2	7 4	5 10	7 10	5 12	7 11	6 1	97 3	13 14
6	Cross Sht.-horn	Aged	Jan. 13	1,125	12 13	8 15	12 11	8 4	12 10	8 6	12 13	7 10	12 0	8 6	12 9	7 15	12 2	8 10	145 12	20 13
7	Cross Sht.-horn	6	May 2	1,109	17 2	12 2	17 14	11 12	17 0	12 15	16 8	10 12	17 3	12 8	17 4	12 2	16 7	11 15	208 14	29 8
8	Cross Ayrshire	3	Apr. 13	854	11 7	7 9	12 10	7 13	11 14	8 8	11 11	7 0	11 5	8 8	12 4	7 4	11 6	8 0	137 3	19 10
9	Cross Sht.-horn	Aged	Feb. 16	1,136	12 11	8 4	12 1	8 4	12 6	9 0	11 4	7 8	12 12	9 5	13 1	8 7	12 5	8 8	146 12	20 13
10	Ayrshire	6	Apr. 3	950	17 2	11 2	16 1	10 10	15 7	11 9	15 0	8 10	14 6	10 14	16 7	10 1	14 10	10 6	188 5	26 1
11	Guernsey	4	Mar. 30	851	12 0	9 0	13 0	7 11	12 5	8 13	12 9	6 14	11 5	9 0	12 6	8 1	12 5	7 5	149 14	20 7
12	Cross Sht.-horn	7	Nov. 10	1,152	10 1	7 5	9 8	6 10	9 4	6 14	11 1	5 15	10 1	7 3	8 4	6 1	9 8	6 11	114 4	16 8

Third Season, 1863; 7 days.—May 26 to June 1.

Five Cows.*—Unsewaged Meadow Grass.

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 25). lbs.	Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop				Rye, † Crop 1.		Rye, † Crop 1.		Rye, † Crop 1.		Rye, † Crop 1.		Rye, † Crop 1.		Rye, † Crop 1.		Rye, † Crop 1.		—	—
	Quantities weighed (tons. cwts. qrs. lbs.)				0 6 2 6		0 6 0 0		0 5 0 20		0 3 3 0		0 4 2 2		0 3 0 0		0 5 0 0		1 14 0 0	0 0 2 26
Yield of Milk, &c.					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross short-horn	Aged	May 1	1,064	23 1	13 12	23 1	13 4	25 0	15 8	23 2	15 6	24 8	16 9	24 8	16 1	23 1	14 10	200 12	40 2
2	Cross short-horn	6	Feb. 15	1,181	18 5	11 0	16 14	10 13	17 0	10 14	17 3	8 7	14 12	12 8	16 1	11 2	14 4	9 0	188 5	26 14
3	Cross short horn	2	April 13	818	16 3	11 4	16 14	10 13	17 3	10 0	16 12	10 5	17 2	10 8	16 7	9 12	13 4	8 8	164 3	23 8
4	Cross short-horn	6	May 20	1,098	27 14	12 14	27 14	12 13	23 10	19 0	23 6	14 4	26 6	19 8	25 12	15 8	24 9	14 15	288 2	41 14
5	Cross short-horn	7	April 17	1,112	21 2	14 4	20 14	17 10	22 0	11 15	20 0	12 6	22 3	18 6	21 0	13 8	21 0	12 9	244 3	34 14
			Totals	5,274	108 9	63 2	107 9	67 0	104 15	67 14	104 9	62 13	102 13	71 14	104 9	63 13	95 3	61 10	1,190 7	—
			Means	1,055	21 11	13 1	21 8	13 8	21 0	13 9	20 15	12 9	20 9	14 6	20 13	13 8	19 0	12 5	238 1	34 0

Ten Cows.—Sewaged Meadow Grass.

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 25). lbs.	Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop				Five-acre, Plots 2 & 3, Crop 1.		Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		—	—
	Quantities weighed (tons. cwts. qrs. lbs.)				1 2 3 7		0 16 0 0		0 11 1 25		0 10 2 5		0 10 1 12		0 12 1 11		0 12 1 17		4 15 3 10	0 1 1 13
Yield of Milk, &c.																				
1	Cross short-horn	Aged	Mar. 10	1,136	17 6	13 0	20 0	13 2	19 7	14 13	21 1	14 5	16 1	13 0	19 4	13 12	16 2	13 13	236 2	33 8
2	Cross short-horn	Aged	April 7	1,013	23 8	15 5	23 12	14 15	25 12	15 9	25 6	15 12	25 8	14 8	23 4	14 4	20 7	11 15	271 3	38 12
3	Cross short horn	6	Feb. 20	1,050	17 8	13 1	17 6	13 0	16 6	13 0	17 2	13 7	14 0	11 1	15 8	13 6	16 10	12 0	210 15	28 11
4	Cross short-horn	7	Feb. 15	990	14 0	11 12	16 10	12 7	17 12	12 4	17 12	13 4	17 11	13 0	16 4	12 5	16 14	9 9	202 7	28 15
5	Ayrshire	8	Feb. 22	954	14 0	11 4	15 15	9 11	10 4	11 4	10 14	10 14	14 10	10 11	15 4	10 3	14 4	10 1	181 9	25 15
6	Cross short horn	6	April 14	930	19 8	12 1	21 2	12 12	21 4	14 9	25 6	14 2	22 1	19 5	20 0	13 7	19 0	11 0	237 10	33 15
7	Mongrel	Aged	April 12	838	17 0	12 5	18 8	11 11	20 5	13 0	20 6	12 15	18 0	10 11	17 5	10 8	14 7	9 3	206 13	29 9
8	Cross short horn	6	April 10	1,026	11 0	10 3	11 8	15 6	12 3	15 4	11 6	17 1	13 10	16 14	14 0	10 4	15 3	12 2	193 13	27 11
9	Cross short-horn	7	April 13	954	19 1	13 0	21 0	11 11	19 1	12 8	20 4	13 6	18 8	14 13	18 2	15 0	15 3	12 14	225 13	31 15
10	Half short-horn	Aged	Oct. 20	1,336	13 3	8 10	12 8	8 11	12 2	9 10	13 0	8 11	11 10	8 11	13 1	8 5	10 0	4 3	141 8	20 3
			Totals	10,312	106 1	124 15	177 13	121 12	160 8	131 3	165 13	132 15	173 12	128 0	174 6	131 9	160 0	105 12	2,085 10	—
			Means	1,031	16 10	12 8	17 12	12 3	16 1	13 2	16 11	13 4	17 6	12 13	17 7	13 2	16 1	10 9	208 9	29 13

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 25). lbs.	Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop				Rye, † Crop 1.		Rye, † Crop 1.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye,' Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		—	—
	Quantities weighed (tons. cwts. qrs. lbs.)				0 8 1 6		0 7 2 10		0 7 1 13		0 2 3 17		0 7 3 12		0 6 1 23		0 6 2 0		2 6 3 27	0 1 1 10
Yield of Milk, &c.																				
1	Cross short-horn	Aged	April 20	1,122	28 2	18 0	28 6	17 3	20 10	17 9	20 1	17 7	20 3	20 12	20 15	17 12	27 5	18 0	320 7	46 10
2	Ayrshire	6	Mar. 15	902	18 5	13 9	20 11	18 9	22 18	13 11	21 14	13 11	21 10	13 4	21 0	11 2	19 5	11 3	251 14	35 11
3	Cross short-horn	Aged	Mar. 1	1,106	16 8	9 1	17 0	10 3	17 8	10 6	16 14	5 6	16 12	11 7	16 4	10 4	15 6	9 1	184 2	26 5
4	Cross short horn	Aged	April 15	1,176	24 6	18 12	24 5	16 14	23 14	13 0	24 0	16 1	26 0	16 4	23 6	12 2	21 0	12 14	270 7	38 10
5	Cross short-horn	6	Jan. 2	1,048	19 2	15 10	18 8	10 0	16 8	9 12	18 3	10 4	16 6	12 0	16 6	9 0	15 6	6 8	199 11	27 4
			Totals	5,354	106 7	73 1	107 0	67 15	110 5	66 6	100 2	62 15	[illegible] 14	73 11	106 1	60 11	98 11	57 8	1,207 9	—

Table IX.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—September 12 to September 18.

THREE COWS.—UNSEWAGED GRASS.

Food consumed (tons, cwts., qrs., lbs.)

—	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	Ten-acre, Plot 1, Crop 2.	*	*	*	—	—
Grass: Quantities weighed	0 4 1 17½	0 3 1 4½	0 3 1 7½	0 3 1 10	0 4 1 6	0 3 3 3	0 3 3 6	1 6 0 23½	0 1 1 0
Oilcake (equal parts linseed and rape cake)	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 3 0	0 0 0 4

Yield of Milk, &c. (lbs., ozs.)

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tue. A.M.	Tue. P.M.	Wed. A.M.	Wed. P.M.	Thu. A.M.	Thu. P.M.	Total in 7 days	Per head per day
1	Cross Sht.-horn	6	Mar. 20	1,050	14 15	11 0	14 15	11 10	11 10	9 14	15 0	10 6	12 4	10 0	13 9	11 4	13 4	9 8	169 9	24 4
2	Cross Sht.-horn	7	Dec. 23	1,190	6 0	7 6	6 1	8 8	6 4	6 11	7 1	7 9	5 0	6 6	6 0	5 9	5 15	5 10	90 0	12 14
3	Cross Sht.-horn	Aged	Feb. 20	1,020	10 12	11 6	10 4	11 5	16 4	9 10	14 10	11 3	12 10	9 12	15 0	11 3	14 10	10 2	180 13	25 13
	Totals			3,276	37 11	30 4	37 4	31 7	34 2	26 3	36 11	29 2	20 14	26 2	34 9	28 0	33 13	25 4	440 6	—
	Means			1,028	12 9	10 1	12 7	10 8	11 6	8 12	12 4	9 11	9 15	8 11	11 9	9 6	11 4	8 7	146 13	21 0

TWELVE COWS.—SEWAGED GRASS.

Food consumed (tons, cwts., qrs., lbs.)

—	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plot 3, Crop 3.	—	—
Grass: Quantities weighed	0 15 2 10	0 15 2 15	0 16 3 8	0 15 3 8	1 0 3 23	0 17 1 15	1 0 2 23	6 2 3 21	0 1 1 24
Oilcake (equal parts linseed and rape cake)	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 3 0 0	0 0 0 4

Yield of Milk, &c. (lbs., ozs.)

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18.) lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tue. A.M.	Tue. P.M.	Wed. A.M.	Wed. P.M.	Thu. A.M.	Thu. P.M.	Total in 7 days	Per head per day
1	Cross Sht.-horn	6	Nov. 18	1,270	11 0	8 3	10 14	7 14	13 4	8 11	11 8	7 3	11 4	6 4	11 0	7 12	10 12	7 14	133 2	19 1
2	Cross Sht.-horn	8	Feb. 2	1,207	7 8	5 0	7 6	5 3	8 14	6 11	7 8	5 1	7 6	6 10	7 9	5 8	7 4	5 6	91 14	13 2
3	Cross Sht.-horn	6	Dec. 1	1,238	8 14	6 1	8 2	6 9	9 0	7 5	7 10	6 0	7 8	6 7	8 2	6 0	8 0	6 9	103 9	14 10
4	Cross Sht.-horn	Aged	Jan. 26	973	9 8	6 6	8 14	6 12	11 12	7 6	9 4	6 3	8 0	5 16	8 11	6 3	8 6	5 1	108 8	15 7
5	Cross Sht.-horn	6	Nov. 17	1,109	7 0	5 4	6 8	6 6	8 14	6 8	7 6	5 0	7 0	5 1	6 13	5 0	6 10	4 13	88 9	12 10
6	Cross Sht.-horn	Aged	Jan. 13	1,150	11 0	7 12	11 4	8 10	13 0	8 10	11 2	7 12	10 8	8 10	11 2	7 13	10 10	7 8	136 11	19 6
7	Cross Sht.-horn	6	May 2	1,106	14 0	11 11	15 0	17 8	17 12	10 7	13 1	12 6	13 10	11 3	15 9	11 0	15 0	11 0	190 1	27 2
8	Cross Ayrshire	3	Apr. 13	850	11 12	8 4	11 13	8 1	13 12	7 7	13 0	7 9	10 0	8 1	11 7	7 5	10 4	7 8	136 14	19 7
9	Cross Sht.-horn	Aged	Feb. 10	1,232	10 6	7 4	9 12	8 4	11 4	8 14	10 10	7 13	9 0	7 14	10 3	8 4	10 14	7 4	127 10	18 4
10	Ayrshire	6	Apr. 3	900	15 8	10 8	14 13	10 2	17 8	9 13	14 6	10 2	14 2	10 6	14 6	10 0	14 5	10 2	176 2	25 3
11	Guernsey	4	Mar. 20	884	10 9	8 7	11 14	8 8	13 8	7 8	10 14	8 2	9 12	8 2	10 4	8 11	9 10	7 10	133 2	19 0

Three Cows.—Unsewaged Grass.

Food consumed.

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total of 7 days.	... per day.
Grass — From which Field, Plot, and Crop.	*	Ten-acre, Plot 0,† Crop 2.	Ten-acre, Plot 0,† Crop 2.	Ten-acre, Plot 0,† Crop 2.	—	*	Ten-acre, Plot 0,† Crop 2.	—	—
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass — Quantities weighed	0 5 1 24	0 5 1 7	0 5 3 10	0 3 3 11	—	0 5 0 17	0 5 1 4	1 4 3 17	0 1 0 21
Oilcake (equal parts linseed and rape cake)	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 0 12	0 0 3 0	0 0 0 4

Yield of Milk, &c. (lbs. ozs.)

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). lbs.	Friday A.M.	Friday P.M.	Saturday A.M.	Saturday P.M.	Sunday A.M.	Sunday P.M.	Monday A.M.	Monday P.M.	Tuesday A.M.	Tuesday P.M.	Wednesday A.M.	Wednesday P.M.	Thursday A.M.	Thursday P.M.	Total of 7 days	per day
1	Cross Sht.-horn	6	Mar. 20	1,068	13 8	10 0	13 14	10 4	15 14	10 11	14 1	8 1	13 3	9 6	13 12	10 14	15 0	10 1	168 9	24 1
2	Cross Sht.-horn	7	Dec. 23	1,190	6 4	4 1	6 2	6 1	5 8	5 10	6 6	5 12	5 0	5 7	5 10	6 15	6 0	5 1	78 13	11 4
3	Cross Sht.-horn	Aged	Feb. 26	1,020	14 6	10 0	14 12	10 0	15 0	12 0	12 2	10 8	12 1	9 7	10 10	10 1	15 4	10 3	172 6	24 10
		Totals	-	3,278	34 3	24 1	34 12	26 5	36 6	28 5	31 9	24 5	30 4	24 4	30 0	27 14	36 4	25 5	410 12	—
		Means	-	1,092	11 6	8 0	11 9	8 13	12 2	9 7	10 9	8 2	10 1	8 1	13 0	9 5	12 1	8 7	136 15	20 0

Twelve Cows. Sewaged Grass.

Food consumed.

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total of 7 days.	... per day.
Grass — From which Field, Plot, and Crop.	Ten-acre, Plot 3, Crop 3.	Ten-acre, Plots 0† and 3, Crop 3.	*	*	Five-acre, Plot 3, Crop 3.	Five-acre, Plot 3, Crop 3.	Five-acre, Plot 3, Crop 3.	—	—
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass — Quantities weighed	0 15 1 7	0 10 2 16	0 8 3 8	0 8 3 8	0 15 1 9	0 17 0 14	0 16 2 20	5 1 2 26	0 1 0 24
Oilcake (equal parts linseed and rape cake)	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 0 1 20	0 3 0 0	0 0 0 4

Yield of Milk, &c. (lbs. ozs.)

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). lbs.	Friday A.M.	Friday P.M.	Saturday A.M.	Saturday P.M.	Sunday A.M.	Sunday P.M.	Monday A.M.	Monday P.M.	Tuesday A.M.	Tuesday P.M.	Wednesday A.M.	Wednesday P.M.	Thursday A.M.	Thursday P.M.	Total of 7 days	per day
1	Cross Sht.-horn	8	Nov. 18	1,270	11 1	8 2	10 8	7 7	10 0	8 7	10 14	7 3	10 11	7 13	10 14	8 2	10 5	7 10	129 1	18 7
2	Cross Sht.-horn	8	Feb. 2	1,267	9 7	6 6	7 2	6 1	6 8	6 4	7 4	5 8	7 6	5 1	7 6	5 4	7 0	5 6	87 1	12 7
3	Cross Sht.-horn	6	Dec. 1	1,288	7 13	6 7	7 7	6 2	7 3	5 11	7 10	5 3	7 1	5 10	7 9	5 12	6 8	5 6	89 6	13 12
4	Cross Sht.-horn	Aged	Jan. 28	973	8 7	6 2	8 4	5 9	8 1	5 0	9 8	5 8	8 11	6 8	8 0	5 6	8 0	5 11	97 13	14 0
5	Cross Sht.-horn	6	Nov. 17	1,109	7 4	6 0	6 0	4 10	6 2	5 4	9 7	5 0	6 3	4 14	6 6	5 2	6 11	5 3	80 2	11 7
6	Cross Sht.-horn	Aged	Jan. 13	1,150	11 12	7 8	11 6	7 0	10 12	8 8	10 9	7 3	10 12	7 12	13 6	8 0	11 7	9 0	134 15	19 4
7	Cross Sht.-horn	6	May 2	1,106	14 4	11 7	14 15	10 9	13 2	10 15	14 10	9 3	14 4	11 6	16 1	10 5	15 4	11 0	179 5	25 10
8	Cross Ayrshire	3	Apr. 13	850	10 4	7 7	10 8	7 3	11 1	7 7	11 10	6 4	10 1	7 10	11 11	7 6	11 2	7 6	127 2	18 3
9	Cross Sht.-horn	Aged	Feb. 10	1,232	8 8	9 0	9 6	7 1	9 1	8 1	10 4	8 13	10 5	7 6	10 5	7 9	11 10	6 7	124 2	17 12
10	Ayrshire -	6	Apr. 5	900	14 0	9 9	12 8	10 1	13 6	9 11	14 8	9 0	13 4	9 7	13 4	9 4	15 0	8 10	162 10	23 4
11	Guernsey -	4	Mar. 30	834	10 2	7 11	11 0	7 2	11 0	8 1	10 8	7 0	11 4	7 8	11 10	8 2	12 4	7 12	131 0	18 11
12	Cross Sht.-horn	7	Nov. 16	1,146	12 8	8 3	12 10	8 4	10 8	5 6	10 3	7 6	10 0	6 12	10 11	8 3	10 3	6 6	127 5	18 3
		Total	-	13,275	128 6	90 14	121 10	85 1	118 14	88 11	123 15	83 5	120 1	86 11	127 0	88 9	125 6	87 1	1,468 14	—
		Means		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table IX.—continued.

Detailed Record of Food consumed, and Milk yielded, by Cows fed on the Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Second Season, 1862; 7 days.—September 26 to October 2.

Three Cows.—Unsewaged Grass.

Food consumed (tons, cwts., qrs., lbs.)

—	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	..	Ten-acre, Plot 0*, Crop 2.	Ten-acre, Plot 0*, Crop 2.	Ten-acre, Plot 0*, Crop 2.	Ten-acre, Plot 0*, Crop 3.	Ten-acre, Plot 0*, Crop 3.	Ten-acre, Plot 0*, Crop 3.	—	—
Grass: Quantities weighed	—	0 3 1 12	0 4 0 19	0 4 0 10	0 3 1 10	0 3 0 22	0 3 1 12	1 1 2 10	0 1 0 3
Oilcake (3 parts linseed and 2 parts rape cake)	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 0 3 21	0 0 0 5

Milk yielded (lbs. ozs.)

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Mar. 20	1,066	14 0	9 8	14 0	9 4	14 3	8 3	12 4	10 6	14 0	0 12	14 8	9 10	14 0	9 3	102 13	23 4
2	Cross Sht.-horn	7	Dec. 25	1,190	5 6	5 8	3 8	5 12	3 10	5 2	2 2	4 2	2 8	3 11	2 6	4 0	2 0	2 0	51 11	7 6
3	Cross Sht.-horn	Aged	Feb. 26	1,020	14 12	10 14	15 4	10 7	14 7	9 12	12 2	12 2	14 2	10 15	15 6	9 12	10 2	9 7	175 8	25 1
	Totals -			3,276	34 2	25 14	33 12	25 7	33 4	23 1	26 8	26 10	30 10	24 6	32 4	23 6	32 2	20 10	390 0	—
	Means -			1,092	11 6	8 10	10 15	8 8	10 12	7 11	8 13	8 14	10 3	8 2	10 12	7 13	10 11	6 14	130 0	18 0

Twelve Cows.—Sewaged Grass.

Food consumed (tons, cwts., qrs., lbs.)

—	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	Per head per day.
Grass: From which Field, Plot, and Crop.	Five-acre, Plot 3, Crop 3.	Five-acre, Plot 3, Crop 3.	Five-acre, Plot 3, Crop 3.	Five-acre, Plot 3, Crop 3.	†	Ten-acre, Plot 2, Crop 3.	Ten-acre, Plot 2, Crop 3.	—	—
Grass: Quantities weighed	1 0 2 6	0 17 0 23	0 16 3 7	0 16 3 3	0 15 0 20	0 15 1 25	0 12 2 9	5 14 2 8	0 1 1 13
Oilcake (3 parts linseed and 2 parts rape cake)	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 3 3 0	0 0 0 5

Milk yielded (lbs. ozs.)

Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). lbs.	Fri. A.M.	Fri. P.M.	Sat. A.M.	Sat. P.M.	Sun. A.M.	Sun. P.M.	Mon. A.M.	Mon. P.M.	Tues. A.M.	Tues. P.M.	Wed. A.M.	Wed. P.M.	Thurs. A.M.	Thurs. P.M.	Total in 7 days.	Per head per day.
1	Cross Sht.-horn	6	Nov. 18	1,270	10 2	7 11	10 14	7 8	11 0	7 6	10 6	7 4	10 12	8 0	10 14	8 0	11 13	7 11	129 6	18 8
2	Cross Sht.-horn	8	Feb. 2	1,267	6 8	5 10	6 9	6 6	7 1	5 3	7 0	4 13	6 0	4 13	6 13	4 15	6 11	6 0	82 5	11 12
3	Cross Sht.-horn	6	Dec. 1	1,288	7 9	4 11	7 6	5 6	7 6	5 10	7 2	4 13	7 0	4 14	6 10	4 3	6 0	4 4	82 14	11 13
4	Cross Sht.-horn	Aged	Jan. 26	973	7 14	6 1	7 11	6 6	7 10	6 12	7 4	5 10	7 4	5 4	8 6	5 14	8 4	5 6	95 12	13 11
5	Cross Sht.-horn	6	Nov. 17	1,199	6 5	5 2	6 3	4 12	6 12	4 13	6 3	4 10	5 0	4 15	6 6	4 7	5 6	4 8	74 12	10 11
6	Cross Sht.-horn	Aged	Jan. 13	1,150	11 6	9 2	11 12	8 6	11 10	8 3	10 1	7 10	10 4	7 15	11 0	7 12	10 4	8 6	133 11	19 2
7	Cross Sht.-horn	6	May 2	1,106	13 2	11 0	13 6	10 4	14 10	10 13	12 10	9 4	13 1	9 12	14 3	10 10	13 12	9 4	169 11	24 4
8	Cross Ayrshire	3	Apr. 13	880	11 6	8 1	11 14	7 11	12 1	7 0	12 1	6 2	11 0	7 4	11 10	7 15	11 3	6 15	132 3	18 14
9	Cross Sht.-horn	Aged	Feb. 10	1,232	10 7	7 1	11 12	7 8	11 6	7 4	10 4	7 1	10 8	7 0	10 2	7 13	10 12	6 7	125 4	17 14
10	Ayrshire -	6	Apr. 3	869	14 6	7 9	13 4	9 14	16 0	9 9	14 5	8 12	13 0	10 3	14 6	9 4	13 6	9 1	164 10	23 8
11	Guernsey -	4	Mar. 30	834	11 10	8 6	12 4	8 4	12 2	7 7	10 8	7 4	10 12	7 8	11 3	8 3	10 8	8 3	134 0	19 2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	per day.

Three Cows.—Unsewaged Grass.

Food consumed.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	per day.
Grass: From which Field, Plot, and Crop.	Ten-acre, Plot 0,* Crop 2.	Ten-acre, Plot 0,* Crop 2.	Ten-acre, Plot 0,* Crop 2.	Ten-acre, Plot 0,* Crop 2.	†	†	†	—	—
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass: Quantities weighed	0 2 1 9	0 1 3 15	0 1 2 24	0 1 2 24	0 3 3 22	0 3 3 17	0 2 3 6	0 18 1 5	0 0 3 14
Oilcake (3 parts linseed and 2 parts rape cake)	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 0 0 15	0 4 3 21	0 0 0 5

Yield of Milk, &c.

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). lbs.	Friday A.M. lbs. ozs.	Friday P.M. lbs. ozs.	Saturday A.M. lbs. ozs.	Saturday P.M. lbs. ozs.	Sunday A.M. lbs. ozs.	Sunday P.M. lbs. ozs.	Monday A.M. lbs. ozs.	Monday P.M. lbs. ozs.	Tuesday A.M. lbs. ozs.	Tuesday P.M. lbs. ozs.	Wednesday A.M. lbs. ozs.	Wednesday P.M. lbs. ozs.	Thursday A.M. lbs. ozs.	Thursday P.M. lbs. ozs.	Total in 7 days. lbs. ozs.	per day. lbs. ozs.
1	Cross Sht.-horn	6	Mar. 20	1,066	14 2	9 11	13 8	9 13	13 2	9 8	14 10	9 5	13 2	10 0	13 8	9 14	13 3	9 4	163 8	23 5
2	Cross Sht.-horn	7	Dec. 25	1,100	3 4	3 6	3 6	2 7	3 12	2 5	1 12	3 15	1 10	3 8	1 12	2 8	2 4	2 0	31 13	6 4
3	Cross Sht.-horn	Aged	Feb. 20	1,020	14 8	9 15	15 2	10 4	10 6	10 7	13 8	9 7	14 12	11 2	14 4	10 11	13 4	9 15	167 9	23 15
	Totals			3,276	31 14	23 0	32 0	22 8	26 4	22 2	29 14	22 11	29 8	24 10	29 8	23 1	28 11	21 3	366 14	—
	Means			1,093	10 10	7 11	10 11	7 8	8 12	7 6	9 15	7 9	9 14	8 3	9 13	7 11	9 9	7 1	122 5	17 8

Twelve Cows.—Sewaged Grass.

Food consumed.	Friday.	Saturday.	Sunday.	Monday.	Tuesday.	Wednesday.	Thursday.	Total in 7 days.	per day.
Grass: From which Field, Plot, and Crop.	Ten-acre, Plot 2, Crop 3.	Ten-acre, Plot 2, Crop 3.	Ten acre, Plot 2, Crop 3 & Plot 4, Crop 4	Ten acre, Plot 2, Crop 3 & Plot 4, Crop 4.	†	†	†	—	—
	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.	tons. cwts. qrs. lbs.
Grass: Quantities weighed	0 14 2 5	0 13 2 27	0 13 3 0	0 15 3 1	0 19 0 21	0 16 2 25	0 15 3 7	5 6 2 2	0 1 1 1
Oilcake (3 parts linseed and 2 parts rape cake)	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 0 2 4	0 3 3 0	0 0 0 5

Yield of Milk, &c.

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 18). lbs.	Friday A.M. lbs. ozs.	Friday P.M. lbs. ozs.	Saturday A.M. lbs. ozs.	Saturday P.M. lbs. ozs.	Sunday A.M. lbs. ozs.	Sunday P.M. lbs. ozs.	Monday A.M. lbs. ozs.	Monday P.M. lbs. ozs.	Tuesday A.M. lbs. ozs.	Tuesday P.M. lbs. ozs.	Wednesday A.M. lbs. ozs.	Wednesday P.M. lbs. ozs.	Thursday A.M. lbs. ozs.	Thursday P.M. lbs. ozs.	Total in 7 days. lbs. ozs.	per day. lbs. ozs.
1	Cross Sht.-horn	8	Nov. 18	1,270	10 10	8 0	11 2	7 6	11 0	7 0	10 11	6 4	10 7	7 2	10 11	7 8	10 13	7 0	125 10	17 15
2	Cross Sht.-horn	8	Feb. 2	1,267	6 9	5 0	5 12	5 0	8 1	4 15	6 10	5 2	6 2	5 3	7 1	5 4	7 3	5 0	84 4	12 1
3	Cross Sht.-horn	6	Dec. 1	1,288	6 1	4 0	0 0	3 12	5 2	3 7	4 0	2 7	3 1	..	..	1 12	2 6	1 15	44 5	6 5
4	Cross Sht.-horn	Aged	Jan. 26	973	7 5	6 4	7 14	6 2	8 6	6 0	7 6	5 2	7 9	5 4	7 3	4 8	7 9	4 10	90 9	12 15
5	Cross Sht.-horn	6	Nov. 17	1,190	5 11	5 3	5 10	4 10	6 4	4 6	6 0	4 7	6 2	4 9	5 11	4 8	5 7	4 3	72 13	10 6
6	Cross Sht.-horn	Aged	Jan. 13	1,150	10 11	8 0	11 1	7 10	11 8	7 3	10 11	7 14	10 12	8 5	10 13	8 4	10 11	7 10	131 1	18 12
7	Cross Sht.-horn	6	May 2	1,100	14 0	10 12	10 0	13 8	11 2	9 0	14 10	9 9	13 8	10 7	13 11	10 2	13 9	8 9	162 7	23 3
8	Cross Ayrshire	3	Apr. 13	850	10 12	7 6	11 8	7 9	11 2	7 8	11 8	6 6	10 12	7 12	11 7	7 1	10 7	6 13	128 1	19 6
9	Cross Sht.-horn	Aged	Feb. 16	1,232	10 0	7 10	10 4	7 2	13 8	6 14	10 11	7 2	9 12	7 9	10 0	6 15	10 4	5 10	120 5	17 3
10	Ayrshire	6	Apr. 3	960	13 10	9 0	13 13	0 4	14 12	8 11	13 11	8 11	13 12	9 6	14 8	8 10	13 4	8 10	159 10	22 13
11	Guernsey	4	Mar. 30	834	11 3	7 0	11 2	8 5	12 8	7 8	11 2	7 5	10 9	9 0	10 8	7 6	10 2	7 15	131 15	18 14
12	Cross Sht.-horn	7	Nov. 16	1,149	10 12	7 10	10 14	6 4	10 12	6 8	10 1	6 10	9 14	7 1	10 12	7 14	10 4	7 10	122 14	17 9
	Totals			13,273	117 4	86 9	116 0	86 14	121 1	79 2	117 1	76 15	112 4	81 10	112 5	79 12	111 6	75 11	1,375 14	—
	Means			1,106	9 12	7 3	9 11	7 4	10 1	6 9	9 12	6 7	9 6	6 13	9 6	6 10	9 5	6 8	114 9	16 [illegible]

THREE COWS.—UNSEWAGED GRASS.

From which Field, Plot, and Crop.				*				*				*				*				Ten-acre, Plot 0*, Crop 2.								*				—		—	
				tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	
Quantities weighed				0 4		0 0		0 3		1 10		0 3		0 27		0 3		1 0		0 4		0 20						0 4		0 0		1 2 0 1		0 1 0 5	
c (3 parts linseed and 2 parts rape cake)				0 0		0 15		0 0		0 15		0 0		0 15		0 0		0 15		0 0		0 15		0 0		0 15		0 0		0 15		0 0 3 21		0 0 0 5	
Breed.	Years old.	Dates of Calving.	Weights (Oct. 16). lbs.	A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		—		—	
				lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Cross Sht.-horn	6	Mar. 20	1,058	12	4	9	0	12	1	8	10	12	2	8	4	15	0	8	6	13	12	8	5	13	0	7	14	12	12	8	3	148	15	21	4
Cross Sht.-horn	7	Dec. 25	1,219	3	12	2	1	2	6	2	2	2	0	2	9	1	12	1	6	1	14	2	15	1	11	3	8	1	8	2	2	31	10	4	8
Cross Sht.-horn	Aged	Feb. 26	1,058	13	6	10	8	13	11	9	4	13	8	11	8	13	0	10	6	13	0	10	1	13	1	8	0	13	11	8	15	162	7	23	5
		Totals -	3,335	29	8	21	9	23	2	20	0	27	10	22	5	29	12	20	2	28	10	21	5	27	12	19	12	27	5	19	4	343	0	—	
		Means -	1,112	9	13	7	3	9	6	6	11	9	3	7	7	9	14	6	11	9	9	7	2	9	4	6	9	9	2	6	7	114	5	16	5

TWELVE COWS.—SEWAGED GRASS.

	From which Field, Plot, and Crop.				*				Ten-acre, Plot 4, Crop 4.				*				*				Ten-acre, Plot 4, Crop 4.				Ten-acre, Plot 3, Crop 4.				Ten-acre, Plot 3, Crop 4.				—		—	
					tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts.		qrs. lbs.		tons. cwts. qrs. lbs.		tons. cwts. qrs. lbs.	
Grass	Quantities weighed				0 14		1 0		1 5		1 0		0 15		3 26		0 15		3 20		0 17		0 6		0 13		1 0		0 19		1 0		0 0 0 10		0 1 1 20	
Oilcake (3 parts linseed and 2 parts rape cake)					0 0		2 4		0 0		2 4		0 0		2 4		0 0		2 4		0 0		2 4		0 0		2 4		0 0		2 4		0 3 3 0		0 0 0 3	
	Breed.	Years old.	Dates of Calving.	Weights (Oct. 10). lbs.	A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		—		—	
					lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
1	Cross Sht.-horn	6	Nov 18	1,268	10	4	7	15	10	11	8	2	10	7	6	12	10	4	7	7	11	6	7	14	11	1	7	3	10	13	7	5	127	10	18	4
2	Cross Sht.-horn	8	Feb. 2	1,270	6	8	6	3	6	10	4	12	6	11	5	0	6	2	4	14	5	14	5	0	5	12	5	1	5	13	4	7	77	11	11	3
3	Cross Sht.-horn	6	Dec. 1	1,223	3	14	3	8	4	14	3	0	5	0	4	4	5	14	3	9	6	14	3	9	7	1	4	0	7	0	4	7	60	14	9	9
4	Cross Sht.-horn	Aged	Jan 24	936	6	9	5	3	6	11	5	2	6	5	4	10	6	3	4	14	6	0	4	12	5	14	5	12	5	12	4	6	76	3	10	14
5	Cross Sht.-horn	6	Nov. 17	1,214	5	0	4	11	5	2	4	8	6	3	4	12	5	11	4	1	5	2	4	6	5	3	4	4	4	11	4	4	67	0	9	9
6	Cross Sht.-horn	Aged	Jan. 13	1,109	10	0	8	0	10	1	8	15	10	4	7	14	10	4	7	10	10	0	7	12	10	14	7	3	10	10	7	3	127	9	18	4
7	Cross Sht.-horn	6	May 2	1,101	13	1	9	14	14	11	10	9	13	12	10	12	13	6	9	12	13	8	10	4	13	0	9	5	12	6	8	8	163	14	23	4
8	Cross Ayrshire	3	Apr. 13	898	10	15	7	5	10	3	8	4	11	2	7	8	12	4	6	9	10	2	7	9	11	8	7	0	11	0	7	10	128	13	18	6
9	Cross Sht.-horn	Aged	Feb. 10	1,224	7	4	7	4	10	0	5	11	10	4	7	8	10	0	6	15	10	8	7	4	10	9	6	14	10	8	7	12	118	9	16	15
10	Ayrshire -	6	Apr. 3	975	13	0	9	6	13	0	9	9	12	8	8	12	14	2	7	13	12	6	9	2	13	0	5	7	12	0	8	0	143	0	21	11
11	Guernsey -	4	Mar 30	830	11	0	7	15	11	0	8	0	11	0	7	4	11	0	6	8	10	2	8	2	11	2	7	15	10	14	7	13	129	15	18	0
12	Cross Sht.-horn	7	Nov. 10	1,008	10	14	8	15	10	12	7	11	11	1	7	8	11	4	7	10	11	7	7	12	11	4	7	10	11	0	8	14	131	10	19	1
			Totals -	13,101	108	2	83	9	114	1	84	5	113	0	83	8	116	14	77	10	112	12	83	8	116	10	78	8	113	9	82	4	1,368	11	—	
			Means -	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Five Cows.*—Unsewaged

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (April 27) lbs.	Rye, Plot 2, Crop 1. A.M.	Rye, Plot 2, Crop 1. P.M.	Rye, Plot 1, Crop 1. A.M.	Rye, Plot 1, Crop 1. P.M.	Rye, Plot 1, Crop 1. A.M.	Rye, Plot 1, Crop 1. P.M.	Rye, Plot 1, Crop 1. A.M.	Rye, Plot 1, Crop 1. P.M.	Rye, Plot 1, Crop 1. A.M.	Rye, Plot 1, Crop 1. P.M.	Rye, Plot 1, Crop 1. A.M.	Rye, Plot 1, Crop 1. P.M.	Rye, Plot 1, Crop 1. A.M.	Rye, Plot 1, Crop 1. P.M.	—	—
Grass consumed. Quantities weighed (tons, cwts. qrs. lbs.)					0 3 0 0		0 3 2 0		0 7 0 0		0 7 2 0		0 6 0 0		0 3 0 8		0 8 0 7		1 15 0 15	0 1 0 0
Yield of Milk, &c.					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross short horn	Aged	Mar. 1	1,042	17 9	12 8	18 10	11 9	16 2	14 4	18 2	11 8	15 8	13 6	17 9	10 0	19 4	13 6	207 13	29 11
2	Cross short horn	8	Feb. 15	1,117	20 5	15 8	18 4	16 8	19 0	12 12	18 0	13 4	16 11	15 8	17 8	16 8	20 8	14 4	235 14	33 11
3	Cross short horn	5	April 13	746	17 10	12 14	16 4	10 12	13 10	15 1	16 6	11 5	16 12	12 2	18 2	12 1	18 8	9 3	200 10	28 10
4	Cross short-horn	7	Feb. 17	1,080	18 6	13 8	17 6	12 1	15 4	14 12	15 1	11 10	15 11	11 14	8 11	6 0	11 10	8 0	178 0	25 7
5	Cross short-horn	7	April 17	1,056	16 6	15 14	16 0	17 4	17 1	17 3	19 0	11 14	18 6	12 11	20 2	15 0	19 8	15 11	230 0	22 14
			Totals	5,032	89 11	68 4	86 10	67 13	81 1	74 0	86 9	61 9	81 0	65 9	83 0	50 4	89 8	59 8	1,053 4	—
			Means	1,010	17 15	13 10	17 5	13 9	16 4	14 15	17 5	12 5	16 3	13 2	16 6	11 14	17 14	11 14	210 7	30 1

Ten Cows.—Sewaged Meadow Grass.

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (April 27) lbs.	Five-acre, Plot 4, Crop 1. A.M.	Five-acre, Plot 4, Crop 1. P.M.	Five-acre, Plot 4, Crop 1. A.M.	Five-acre, Plot 4, Crop 1. P.M.	— A.M.	— P.M.	Ten acre, Plot 4, Crop 1. A.M.	Ten acre, Plot 4, Crop 1. P.M.	Five-acre, Plot 4, Crop 1. A.M.	Five-acre, Plot 4, Crop 1. P.M.	Five-acre, Plot 4, Crop 1. A.M.	Five-acre, Plot 4, Crop 1. P.M.	Five-acre, Plot 4, Crop 1. A.M.	Five-acre, Plot 4, Crop 1. P.M.	—	—
Grass consumed. Quantities weighed (tons, cwts. qrs. lbs.)					0 17 1 23		0 17 1 17		—		0 6 3 23		0 12 1 23		0 8 0 3		0 8 0 3		3 10 1 8	0 1 0 1
1	Cross short horn	Aged	Mar. 10	1,064	20 6	14 13	18 12	15 13	16 12	15 12	16 8	15 8	17 1	15 12	18 8	14 0	18 4	13 8	235 2	33 9
2	Cross short horn	Aged	April 7	1,080	21 12	18 10	22 1	14 12	21 4	14 4	21 6	13 4	20 10	16 8	25 6	13 10	23 2	14 10	221 8	37 10
3	Cross short-horn	6	Feb. 26	1,020	17 11	14 0	18 0	14 14	16 6	12 11	15 12	11 2	16 2	14 3	17 0	13 7	18 1	13 9	214 7	30 10
4	Cross short horn	7	Feb. 15	1,053	17 12	12 11	15 16	12 10	11 0	12 10	14 14	11 4	14 0	12 0	10 2	12 2	17 6	13 9	193 8	27 14
5	Ayrshire - -	8	Feb. 22	1,002	16 8	13 12	16 3	10 12	14 10	9 11	15 6	10 11	14 4	11 0	13 0	13 8	13 4	11 0	185 9	26 6
6	Cross short horn	6	April 14	880	19 10	10 5	18 6	11 10	20 1	12 2	15 8	14 0	17 8	10 10	18 14	13 0	18 6	14 4	212 5	31 5
7	Moncrel -	Aged	April 19	908	19 0	10 12	18 0	12 1	15 0	9 5	14 2	9 0	13 11	10 8	17 8	11 4	17 4	11 0	192 0	27 7
8	Cross short horn	6	April 18	900	11 6	11 1	13 7	9 11	10 4	10 1	13 6	11 0	12 4	10 14	12 0	11 1	11 10	12 6	140 8	22 12
9	Cross short horn	7	April 13	904	18 0	11 12	19 2	13 2	17 2	13 8	16 7	12 0	18 1	14 7	21 10	14 7	21 8	14 8	225 10	32 4
10	Half short-horn	Aged	Oct. 30	1,220	15 3	19 13	12 11	9 3	12 0	8 8	15 0	11 1	12 0	7 13	13 0	12 2	14 1	11 0	164 15	28 9
			Totals	10,019	177 4	131 4	171 0	123 8	158 0	118 8	157 6	121 7	157 7	124 11	178 0	134 9	174 14	125 12	2,047 9	—
			Means	1,001	17 11	13 2	17 1	12 6	15 13	11 14	15 13	12 2	15 12	12 6	17 5	13 7	17 8	12 9	204 12	30 4

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (April 27) lbs.	Rye, Plot 2, Crop 1. A.M.	Rye, Plot 2, Crop 1. P.M.	Rye, Plot 1, Crop 1. A.M.	Rye, Plot 1, Crop 1. P.M.	Rye, Plot 1, Crop 1. A.M.	Rye, Plot 1, Crop 1. P.M.	Rye, Plot 1, Crop 1 A.M.	Rye, Plot 1, Crop 1 P.M.	Rye, Plot 1, Crop 1. A.M.	Rye, Plot 1, Crop 1. P.M.	Rye, Plot 1, Crop 1. A.M.	Rye, Plot 1, Crop 1. P.M.	Rye, Plot 1, Crop 1. A.M.	Rye, Plot 1, Crop 1. P.M.	—	—
Grass consumed. Quantities weighed (tons, cwts. qrs. lbs.)					0 3 0 0		0 6 1 0		0 6 3 7		0 7 2 20		0 5 1 0		0 8 0 0		0 8 0 6		1 15 0 11	0 1 0 0
1	Cross short-horn	Aged	April 20	1,066	25 0	15 3	25 1	17 0	24 4	20 10	23 6	16 9	21 13	18 4	20 8	15 11	27 9	13 0	246 8	40 15
2	Ayrshire - -	6	Mar. 15	874	22 8	17 2	22 10	16 14	22 3	16 1	21 12	14 1	21 8	14 5	21 0	13 6	23 2	16 8	202 0	37 7
3†	Cross short-horn	Aged	May 1	1,020	15 10	9 3	27 6	10 8	27 4	21 14	24 10	10 14							150 5	29 13
4	Cross short horn	Aged	April 13	1,183	24 6	17 14	21 2	19 9	22 10	19 8	22 4	15 14	23 1	14 12	27 0	18 6	25 10	15 12	280 14	40 3
5	Half short-horn	4	Feb. 8	1,114	15 9	15 15	20 4	12 0	19 0	11 9	18 12	11 3	18 0	10 10	17 12	10 2	18 8	11 0	210 1	30
			Totals	4,259	103 7	75 3	116 7	81 15	115 5	88 10	108 14	77 6	84 6	57 15	86 4	58 11	94 15	55 4	1,089 5	—

Table X.—*continued.*

[...]led Record of Food consumed, and Milk yielded, by Cows fed on Unsewaged and Sewaged Meadow Grass, and on [redacted] Rye Grass (without Oilcake).

Third Season, 1863 ; 7 days.—May 5 to May 11.

Five Cows.*—Unsewaged Meadow Grass.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Grass consumed. From which Field, Plot, and Crop					Rye, Plot 1, Crop 1.		Rye, Plot 0f, Crop 1		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		—	—
Quantities weighed (tons, cwts. qrs. lbs.)					0 6 2 3		0 9 0 16		0 4 0 0		0 5 2 20		0 6 1 16		0 3 2 7		0 3 2 6		1 16 3 11	0 1 0 12
Cows, Nos.	Breed.	Years old.	Dates of Calving.	Weights (Apr. 27). lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
Yield of Milk, &c.					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross short-horn	Aged	Mar. 1	1,012	18 4	11 15	17 6	10 4	17 4	10 0	17 13	10 0	18 8	10 4	18 14	10 11	17 12	11 4	200 8	28 10
2	Cross short-horn	6	Feb. 15	1,117	20 4	12 8	18 2	13 8	18 8	11 8	20 1	12 4	19 1	12 8	18 6	12 16	19 6	13 4	221 14	31 11
3	Cross short-horn	5	April 13	746	17 12	11 10	17 12	10 8	17 4	11 9	14 10	11 1	17 0	10 10	15 6	9 12	16 14	10 0	192 12	27 8
4	Cross short-horn	7	Feb. 17	1,080	9 8	9 0	11 1	9 10	10 10	9 7	10 0	5 15	12 4	8 11	12 0	3 15	12 10	10 1	134 12	19 4
5	Cross short-horn	7	April 17	1,058	10 4	13 5	20 2	12 11	21 0	13 4	20 8	11 13	20 11	13 0	21 4	13 4	21 6	12 14	231 6	33 1
			Totals	5,038	83 0	58 6	84 7	56 9	84 10	55 12	85 0	51 1	87 8	54 12	85 14	50 9	87 0	57 7	980 15	—
			Means	1,010	16 6	11 11	16 14	11 5	16 15	11 2	17 0	10 4	17 8	10 15	17 3	10 2	17 6	11 8	196 3	28 0

Ten Cows.—Sewaged Meadow Grass.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Grass consumed. From which Field, Plot, and Crop					Five-acre, Plot 4, Crop 1.		Five-acre, Plot 4, Crop 1		Five-acre, Plot 4, Crop 1.		—		Ten-acre, Plot 4. Crop 1.		Five-acre, Plot 4, Crop 1.		Five-acre, Plot 4, Crop 1.		—	—
Quantities weighed (tons, cwts. qrs. lbs.)					0 13 1 19		0 12 0 6		0 12 2 22		—		0 17 0 10		0 9 0 17		0 9 0 16		3 10 2 6	0 1 0 10
1	Cross short-horn	Aged	Mar. 10	1,064	18 0	15 1	20 10	16 1	10 6	14 3	21 4	15 6	19 8	15 14	20 0	15 8	19 4	13 1	263 2	34 12
2	Cross short horn	Aged	April 7	1,036	24 2	17 0	25 2	16 8	25 4	18 0	25 8	18 8	26 13	18 7	28 7	18 3	26 3	17 2	304 18	43 0
3	Cross short horn	6	Feb. 20	1,030	17 4	13 11	16 8	11 10	16 6	14 9	17 3	13 4	18 10	13 9	18 0	14 1	20 8	12 13	218 0	31 2
4	Cross short-horn	7	Feb. 15	1,036	17 9	13 8	18 0	12 8	16 14	13 0	17 14	12 10	17 0	12 4	17 2	13 12	16 12	12 0	210 13	30 2
5	Ayrshire	8	Feb. 22	1,012	15 6	12 1	17 4	12 0	16 11	11 8	17 4	10 10	16 0	11 6	17 10	11 9	16 10	10 6	196 14	28 2
6	Cross short horn	6	April 14	980	16 8	14 7	20 12	14 2	20 0	14 6	19 2	13 11	18 11	13 15	21 6	14 0	12 13	13 8	236 14	33 13
7	Mongrel	Aged	April 12	808	16 0	11 6	17 2	11 3	15 3	10 13	14 12	10 4	16 6	11 1	16 8	12 0	14 0	10 10	157 1	26 11
8	Cross short horn	6	April 16	980	13 1	6 8	9 2	7 1	14 1	11 6	17 0	12 14	16 7	11 2	16 1	10 12	17 2	11 2	173 12	24 13
9	Cross short-horn	7	April 13	906	19 12	16 0	21 15	14 1	20 1	14 2	20 4	13 10	20 10	14 5	20 2	15 11	20 0	14 11	245 4	35 1
10	Half short horn	Aged	Oct. 20	1,330	12 6	9 12	13 2	10 5	13 2	10 1	13 2	10 14	12 0	10 11	13 0	10 8	13 10	9 11	168 2	23 3
			Totals	10,043	172 0	129 6	179 9	125 6	177 9	132 0	183 5	131 6	182 9	133 10	186 2	135 14	183 15	126 0	2,178 11	—
			Means	1,004	17 3	12 15	18 0	12 9	17 12	13 3	18 5	13 2	18 4	13 4	18 13	13 10	18 6	12 8	217 14	31 2

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Grass consumed. From which Field, Plot, and Crop					Rye, Plot 1, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		—	—
Quantities weighed (tons, cwts. qrs. lbs.)					0 7 3 13		0 9 2 0		0 4 1 8		0 6 1 9		0 6 0 10		0 5 1 27		0 8 1 26		2 1 0 7	0 1 0 19
1	Cross short-horn	Aged	April 20	1,065	26 6	17 10	26 0	15 2	23 14	10 1	25 9	15 0	27 4	15 6	27 6	16 7	24 10	20 8	201 11	43 2
2	Ayrshire	6	Mar. 15	874	20 2	16 1	21 0	14 5	22 3	14 9	20 6	14 15	21 5	14 7	21 6	14 1	20 14	14 6	260 1	37 2
3	Cross short-horn	Aged	May 1	1,020	27 2	16 9	25 8	19 5	28 14	18 1	22 13	15 9	25 0	17 5	23 4	15 5	24 0	16 1	294 8	42 1

Five Cows.*—Unsewaged Meadow Grass.

Grass consumed.	From which Field, Plot, and Crop				Rye, [illegible] 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Total in 7 days.	Per head per day.
	Quantities weighed (tons, cwts, qrs. lbs.)				0 7 0 0		0 6 3 8		0 5 2 0		0 5 1 0		0 6 2 0		0 5 2 11		0 8 2 10		2 1 1 1	0 1 0 20
Yield of Milk, &c. Cows Nos.	Breed.	Years old	Dates of Calving.	Weights (April 27) lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross short-horn	Aged	Mar. 1	1,042	16 9	11 14	16 12	10 5	17 10	10 8	18 9	11 10	17 4	11 8	17 5	9 6	18 8	9 8	196 13	28 2
2	Cross short horn	6	Feb. 15	1,117	20 0	11 15	18 9	12 9	18 2	13 3	17 10	13 6	18 15	11 8	16 8	11 8	18 9	11 0	210 6	30 1
3	Cross short horn	3	April 13	745	18 0	10 14	17 8	11 0	17 12	10 15	17 15	11 7	16 10	10 12	17 4	10 12	18 2	9 14	196 13	28 2
4	Cross short-horn	7	Feb. 17	1,060	10 1	8 5	11 10	7 13	11 10	9 8	13 6	8 12	13 4	9 6	12 11	7 6	13 11	7 4	143 10	20 8
5	Cross short horn	7	April 17	1,038	20 0	13 5	22 1	13 10	21 8	15 10	22 12	14 6	22 4	13 8	21 0	13 2	22 14	12 6	246 4	35 3
			Totals	5,003	85 9	56 5	86 8	55 5	86 10	57 12	88 15	58 9	88 6	56 7	84 12	53 2	91 12	50 0	988 13	—
			Means	1,010	16 8	11 4	17 5	11 1	17 8	11 9	17 12	11 11	17 4	11 5	16 15	10 7	18 6	10 0	196 13	28 6

Ten Cows.—Sewaged Meadow Grass.

Grass consumed.	From which Field, Plot, and Crop				Five-acre, Plot 3, Crop 1.		Five-acre, Plot 3, Crop 1.		Five-acre, Plot 3, Crop 1.		Ten-acre, Plot 4, Crop 1.		Ten-acre, Plot 4, Crop 1.		Ten-acre, Plot 3, Crop 1.		Ten-acre, Plot 3, Crop 1		—	—
	Quantities weighed (tons, cwts, qrs. lbs.)				0 19 1 13		0 11 2 19		0 14 2 8		0 16 1 6		0 13 2 14		0 7 1 13		0 7 1 19		4 10 1 5	0 1 1 5
Yield of Milk, &c.																				
1	Cross short-horn	Aged	Mar. 10	1,064	19 15	15 6	22 4	14 6	20 0	14 7	20 8	15 15	19 8	15 8	19 8	13 8	19 2	13 2	342 11	34 11
2	Cross short-horn	Aged	April 7	1,036	26 0	17 13	26 10	19 4	27 5	18 4	27 1	18 2	27 1	20 4	27 9	16 0	26 2	16 0	318 7	44 12
3	Cross short-horn	6	Feb. 20	1,030	18 4	14 10	20 10	14 0	19 3	14 11	17 2	15 6	18 10	15 15	18 10	14 1	19 0	13 4	320 5	32 12
4	Cross short horn	7	Feb. 15	1,031	16 4	12 10	17 11	12 3	17 6	12 8	17 12	13 1	17 4	13 6	18 6	11 2	16 11	10 15	300 7	29 15
5	Ayrshire	6	Feb. 22	1,002	15 0	11 2	16 14	10 6	17 9	12 0	16 14	12 3	16 2	12 8	16 8	11 1	17 0	9 6	194 8	27 13
6	Cross short horn	6	April 14	860	20 6	13 0	19 8	12 13	18 12	14 8	21 8	12 15	20 13	16 1	21 14	12 12	20 6	12 6	320 0	34 3
7	Mongrel	Aged	April 12	808	16 6	9 15	10 1	11 6	20 2	12 5	18 15	13 8	19 3	12 8	19 0	10 12	17 6	10 1	306 6	30 5
8	Cross short horn	6	April 16	960	14 6	11 12	14 0	11 4	13 12	11 13	18 0	15 0	13 8	13 1	13 0	11 14	14 0	10 6	276 8	25 7
9	Cross short horn	7	April 13	906	16 0	15 8	20 6	14 1	20 5	13 14	20 12	15 12	20 5	13 3	19 0	14 12	20 9	13 1	340 8	34 6
10	Half short-horn	Aged	Oct. 20	1,320	13 12	9 11	12 8	9 12	13 1	10 14	18 12	11 2	13 0	10 8	13 4	8 12	14 0	8 9	182 9	26 4
			Totals	10,043	175 7	131 7	186 8	130 11	187 6	135 0	186 6	141 3	184 5	142 10	185 1	124 10	186 4	116 2	2,218 0	—
			Means	1,004	17 14	13 2	18 11	13 1	18 12	13 8	[illegible] 10	14 2	18 7	14 4	18 8	12 7	18 10	11 10	221 10	31 11

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Grass consumed.	From which Field, Plot, and Crop				Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, [illegible] 0f, Crop 1.		Rye, Plot 0f, Crop 1.		Rye, Plot 0f, Crop 1		—	—
	Quantities weighed (tons, cwts, qrs. lbs.)				0 7 0 2		0 7 1 0		0 5 2 20		0 6 1 20		0 7 0 0		0 3 0 6		0 6 0 5		2 1 1 24	0 1 0 22
Yield of Milk, &c.																				
1	Cross short-horn	Aged	April 20	1,066	20 1	17 0	27 2	19 1	28 0	19 8	27 6	21 7	26 12	19 14	26 8	17 8	27 1	16 6	321 15	46 0
2	Ayrshire	6	Mar. 15	674	21 10	15 4	22 5	15 9	22 9	14 9	22 6	16 0	23 3	14 3	21 10	13 12	22 4	13 8	257 7	36 12
3	Cross short-horn	Aged	May 1	1,090	25 6	15 10	25 6	17 10	25 11	18 8	24 0	17 9	25 4	17 8	25 14	16 14	25 9	16 4	295 9	42 4
4	Cross short horn	Aged	April 13	1,188	16 12	10 14	20 0	13 1	20 7	12 4	23 1	18 9	22 0	16 9	22 2	10 7	18 12	11 11	230 9	32 15
5	Half short horn	4	Feb. 6	1,114	2 6	2 3	2 9	3 6	3 9	3 0	3 8	2 5	3 0	1 8	3 2	1 10	3 0	1 8	36 8	5 3
			Totals	5,239	94 5	61 5	97 6	68 11	100 4	65 6	99 5	69 14	100 3	62 10	99 4	60 3	97 8	59 1	1,142 0	—

Third Season, 1863; 7 days.—May 19 to May 25.

Five Cows.*—Unsewaged Meadow Grass.

Grass consumed.					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
From which Field, Plot, and Crop					Rye, Plot 6†, Crop 1.		Rye, Plot 6†, Crop 1.		Rye, Plot 6†, Crop 1.		Rye, ‡ Crop 1.		Rye, ‡ Crop 1.		Rye, ‡ Crop 1.		Rye, ‡ Crop 1.		—	—
Quantities weighed (tons, cwts, qrs, lbs.)					0 0 2 0		0 5 2 0		‡0 5 1 0		0 6 1 0		0 6 0 7		0 3 3 14		0 3 3 14		1 19 1 7	0 1 0 10
Yield of Milk, &c. Cows, Nos.	Breed.	Years old.	Dates of Calving.	Weights (May 25) lbs	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
10	Cross short-horn	Aged	May 1	1,064	16 1	10 6	17 12	8 15	17 4	10 12	17 5	9 6	14 4	10 6	16 14	9 1	17 8	9 12	165 11	23 11
2	Cross short-horn	6	Feb. 13	1,164	17 9	10 15	15 1	9 13	17 7	11 2	16 11	12 6	17 6	12 8	18 1	10 12	18 4	10 10	198 6	28 5
3	Cross short-horn	4	April 13	818	16 12	10 8	16 15	9 5	16 15	10 11	16 10	10 8	17 0	10 7	18 4	9 13	17 13	10 8	192 10	27 8
4¶	Cross short-horn	8	May 21	1,496	12 11	7 2	11 14	8 8	10 5	8 10	11 7	9 15	10 1	6 13	13 0	5 11	12 12	6 1	134 12	19 4
5	Cross short-horn	7	April 17	1,112	22 7	12 13	22 8	12 9	21 8	11 4	22 7	13 11	20 0	13 8	21 6	12 8	21 2	13 4	249 5	35 10
			Totals	5,274	85 8	51 14	84 2	49 2	82 5	53 7	85 8	55 14	81 9	53 7	87 9	47 13	87 7	50 3	901 12	—
			Means	1,055	17 2	10 6	16 13	9 13	16 10	11 1	17 2	11 3	16 15	10 11	17 8	9 9	17 8	10 1	192 6	27 8

Ten Cows.—Sewaged Meadow Grass.

Grass consumed.					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
From which Field, Plot, and Crop					Five-acre, Plot 3, Crop 1.		Five-acre, Plot 3, Crop 1.		Five acre, Plot 3, Crop 1.		Ten acre, Plot 3, Crop 1.		Ten-acre, Plot 3, Crop 1.		Ten-acre, Plot 3, Crop 1.		Ten-acre, Plot 3, Crop 1.		—	—
Quantities weighed (tons, cwts, qrs, lbs.)					0 10 0 14		0 14 1 4		0 13 2 7		0 14 2 21		0 15 3 7		0 7 3 13		0 7 3 23		4 10 1 13	0 1 1 5
Yield of Milk, &c.					A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.		
1	Cross short-horn	Aged	Mar. 10	1,138	17 12	14 2	20 4	14 11	18 6	14 5	18 10	13 3	16 10	19 7	19 0	12 10	19 10	13 5	225 6	32 3
2	Cross short-horn	Aged	April 7	1,010	25 5	16 13	27 12	16 14	20 6	17 1	25 6	15 10	24 1	15 7	23 4	14 10	26 4	14 3	291 0	41 9
3	Cross short-horn	6	Feb. 20	1,030	16 5	13 4	16 10	14 14	17 4	13 6	16 1	13 6	15 4	14 11	16 0	11 8	14 0	11 6	208 1	29 11
4	Cross short-horn	7	Feb. 15	980	16 8	11 13	18 3	11 14	17 0	11 10	17 8	11 15	17 2	11 0	16 8	11 0	16 10	11 14	200 15	28 11
5	Ayrshire	8	Feb. 22	784	13 12	9 13	17 0	9 6	15 6	10 9	15 2	10 2	14 0	9 15	15 0	10 0	14 6	9 10	174 15	25 0
6	Cross short-horn	6	April 14	858	19 0	14 8	19 4	13 0	18 12	13 6	20 4	14 15	19 0	13 4	19 0	11 0	20 7	12 14	229 0	32 13
7	Mongrel	Aged	April 12	846	16 14	11 4	14 8	11 4	18 1	12 2	16 7	11 0	16 8	10 14	17 1	10 4	16 8	10 0	200 11	28 11
8	Cross short-horn	6	April 16	1,085	13 6	11 9	13 12	12 9	12 4	10 12	10 9	10 8	11 4	10 10	13 4	10 12	14 12	11 9	165 8	23 10
9	Cross short-horn	7	April 13	934	20 12	13 8	19 14	13 4	20 5	14 8	20 9	13 2	18 0	12 0	18 1	14 12	20 10	13 5	231 4	33 1
10	Half short-horn	Aged	Oct. 30	1,358	12 0	9 5	13 13	9 4	12 0	10 0	12 10	10 2	13 5	9 7	12 6	9 0	12 12	7 14	154 0	22 0
			Totals	10,312	172 5	125 15	184 14	130 12	175 12	127 11	173 2	128 13	168 1	130 1	171 7	116 0	181 15	114 9	2,081 5	—
			Means	1,031	17 4	12 9	18 8	12 11	17 9	12 12	17 5	12 5	16 10	13 0	17 2	11 10	18 3	11 7	208 2	29 12

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Grass consumed.					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
From which Field, Plot, and Crop					Rye, Plot 6†, Crop 1		Rye, Plot 6†, Crop 1		Rye, § Crop 1.		Rye, § Crop 1.		Rye, § Crop 1.		Rye, § Crop 1.		Rye, § Crop 1.		—	—
Quantities weighed (tons, cwts, qrs, lbs.)					0 6 2 0		0 6 1 4		0 5 1 0		0 4 1 4		0 6 2 0		0 3 3 4		0 3 3 3		1 18 1 20	0 1 0 11
Yield of Milk, &c.					A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.		
1	Cross short-horn	Aged	April 20	1,192	26 4	17 10	25 0	18 10	24 2	19 0	24 0	19 12	26 15	19 0	31 4	16 12	29 7	17 13	308 4	44 10
2	Ayrshire	6	Mar. 15	962	21 12	12 11	21 14	13 0	22 0	14 0	22 0	13 15	25 7	14 0	21 8	12 4	21 0	13 0	248 11	35 4
3‖	Cross short-horn	Aged	Mar. 1	1,100	25 12	15 4	24 4	15 14	21 2	17 0	23 7	17 8	23 0	16 10	25 12	14 9	25 12	16 0	286 9	40 15
4	Cross short-horn	Aged	April 15	1,176	20 8	13 15	23 14	14 12	21 14	14 10	20 8	13 10	22 4	14 5	24 8	13 11	25 13	14 10	257 14	36 13
5**	Cross short-horn	6	Jan. 3	1,046	2 6	1 7	2 1	1 6	1 8	0 11	1 0	0 8	0 6	0 8	16 4	10 10	16 4	11 10	68 0	9 11
			Totals	5,354	96 10	60 15	96 10	63 4	97 10	65 5	93 5	65 0	100 0	64 4	119 4	67 14	120 4	73 3	1,163 6	—
			Means	1,071	19 6	12 3	19 5	12 10	19 9	13 1	19 1	13 0	20 0	12 14	23 14	13 9	24 1	14 10	257 9	36 14

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		[illegible]				—	—

Five Cows.*—Unsewaged Meadow Grass.

Grass consumed.	From which Field, Plot, and Crop				† Rye, Crop 1.		† Rye, Crop 1.		† Rye, Crop 1.		† Rye, Crop 1.		† Rye, Crop 1.		† Rye, Crop 1.		† Rye, Crop 1.		—	—
	Quantities weighed (tons, cwts, qrs, lbs.)				0 6 2 0		0 6 0 0		0 5 0 20		0 3 8 0		0 4 2 2		0 5 0 0		0 5 0 0		1 14 0 0	0 0 3 25
Yield of Milk, &c. Cows. Nos.	Breed.	Years old.	Dates of Calving	Weights (May 25), lbs.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	lbs. oz.	lbs. oz.
1	Cross short-horn	Aged	May 1	1,404	23 1	15 12	23 1	15 4	25 0	15 8	23 2	15 0	24 6	16 0	24 5	16 1	23 1	14 10	280 12	40 2
2	Cross short-horn	6	Feb. 15	1,184	18 6	11 0	16 14	10 13	17 0	10 14	17 8	6 7	14 12	12 8	16 1	11 2	14 4	9 0	188 2	26 14
3	Cross short horn	8	April 13	816	16 8	11 4	16 14	10 13	17 5	10 0	16 12	10 5	17 2	10 8	16 7	9 12	13 4	8 8	164 5	23 5
4	Cross short-horn	8	May 20	1,086	27 14	13 14	27 14	12 10	21 10	19 9	25 8	16 4	24 6	19 8	25 12	15 8	24 9	10 15	288 3	41 14
5	Cross short-horn	7	April 17	1,112	21 2	14 4	20 14	17 10	22 0	11 15	20 0	12 6	22 2	13 6	21 6	13 8	21 0	12 9	244 3	34 14
			Totals	5,374	108 9	65 2	107 9	67 9	104 15	67 14	104 9	63 13	108 13	71 14	104 2	65 15	93 2	61 10	1,190 7	—
			Means	1,055	21 11	13 1	21 8	13 8	21 0	13 9	20 15	13 9	20 9	14 6	20 13	13 2	18 0	12 5	238 1	34 0

Ten Cows.—Sewaged Meadow Grass.

Grass consumed.	From which Field, Plot, and Crop				Five-acre, Plots 2 & 3, Crop 1.		Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		—	—
	Quantities weighed (tons, cwts, qrs, lbs.)				1 2 3 7		0 10 0 0		0 11 1 23		0 10 2 5		0 10 1 12		0 12 1 11		0 12 1 17		4 13 3 19	0 1 1 15
Yield of Milk, &c. 1	Cross short-horn	Aged	Mar. 10	1,136	17 6	13 0	20 0	19 2	19 7	13 13	21 1	14 5	18 1	18 0	19 4	15 12	18 3	13 13	239 2	33 5
2	Cross short-horn	Aged	April 7	1,010	23 8	15 5	21 12	14 15	23 12	15 9	23 0	15 12	23 8	14 8	28 4	14 4	20 2	11 15	271 3	34 12
3	Cross short horn	6	Feb. 20	1,000	17 8	13 1	17 0	13 0	16 0	13 6	17 2	13 7	14 0	11 1	15 8	13 6	16 10	13 0	200 13	29 11
4	Cross short-horn	7	Feb. 15	990	14 9	11 13	16 10	12 7	17 12	12 4	17 12	13 4	17 11	13 0	16 4	13 5	16 14	9 0	202 7	28 15
5	Ayrshire - -	8	Feb. 22	981	14 6	11 4	15 15	9 11	16 4	11 4	16 14	10 14	14 10	10 11	15 4	10 3	14 4	10 1	181 9	25 13
6	Cross short-horn	9	April 14	930	19 8	13 1	21 2	12 12	21 4	14 9	21 8	14 2	22 1	12 5	20 6	13 7	19 9	11 0	237 10	33 15
7	Mongrel - -	Aged	April 12	835	17 0	12 5	18 8	15 11	20 5	13 0	20 8	12 15	18 6	10 11	17 5	10 8	14 7	9 3	200 13	29 0
8	Cross short horn	6	April 16	1,036	11 0	16 3	11 5	15 8	12 5	13 4	11 6	17 1	13 10	16 14	14 0	10 4	15 3	12 3	193 13	27 11
9	Cross short horn	7	April 13	954	10 1	12 6	21 0	11 14	19 1	12 8	20 4	13 6	16 8	14 13	18 2	15 0	15 3	12 14	223 13	31 13
10	Half short-horn	Aged	Oct. 30	1,356	12 3	6 10	12 8	8 11	12 2	9 10	13 0	8 11	11 10	8 11	13 1	8 8	10 0	4 3	141 8	20 3
			Totals	10,312	166 1	124 15	177 13	121 12	180 8	131 3	186 13	132 13	173 12	129 0	174 6	121 0	160 6	106 13	2,085 10	—
			Means	1,031	16 10	12 8	17 12	12 3	18 1	13 2	18 11	13 4	17 6	12 13	17 7	12 2	16 1	10 6	208 9	29 13

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Grass consumed.	From which Field, Plot, and Crop				† Rye, Crop 1.		† Rye, Crop 1.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		—	—
	Quantities weighed (tons, cwts, qrs, lbs.)				0 8 1 6		0 7 2 10		0 7 1 15		0 9 3 17		0 7 3 12		0 6 1 23		0 6 2 0		2 6 3 27	0 1 1 10
Yield of Milk, &c. 1	Cross short-horn	Aged	April 20	1,122	28 2	18 0	28 8	17 3	29 10	17 0	29 1	17 7	29 2	20 12	20 15	17 15	27 5	18 0	326 7	46 10
2	Ayrshire - -	6	Mar. 15	902	18 5	13 9	20 11	13 9	22 13	13 11	21 14	18 11	21 10	13 4	21 0	11 2	19 8	11 3	235 14	33 11
3	Cross short-horn	Aged	Mar. 1	1,106	16 8	9 1	17 0	10 5	17 8	10 6	16 14	5 8	18 12	11 7	16 4	10 4	15 6	9 1	184 2	26 5
4	Cross short horn	Aged	April 15	1,178	24 6	13 13	24 5	16 14	22 14	13 0	24 0	16 1	25 0	16 4	22 8	17 6	21 0	12 14	270 7	38 10
5	Cross short-horn	6	Jan. 2	1,048	19 2	15 10	16 8	10 0	16 8	9 12	16 5	10 4	16 0	13 0	16 6	9 0	15 8	8 6	190 11	27 4
			Totals	5,354	106 7	72 1	107 0	67 13	110 5	66 6	108 2	69 15	109 14	72 11	100 1	60 11	98 11	57 8	1,307 9	—

Table X.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on Unsewaged and Sewaged Meadow Grass, and on Italian Rye Grass (without Oilcake)

Third Season, 1863; 7 days.—June 2 to June 8.

Five Cows.*—Unsewaged Meadow Grass.

	Cows. Nos.	Breed	Years old	Dates of Calving	Weights (May 25) lbs.	Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	Total in 7 days.	Per head per day.
Grass consumed. From which Field, Plot, and Crop						† Rye, Crop 1.		† Rye, Crop 1.		† Rye, Crop 1.		† Rye, Crop 1.		† Rye, Crop 1.		† Rye, Crop 1.		† Rye, Crop 1.		—	—
Quantities weighed (*tons. cwts. qrs. lbs.*)						0 5 3 14		0 4 2 2		0 8 3 14		0 4 2 0		0 4 0 0		0 5 2 4		0 5 2 4		1 19 3 10	0 1 0 15
Yield of Milk, &c.						*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*
	1	Cross short horn	Aged	May 1	1,062¾	24 14	14 9	24 10	14 14	23 11	14 9	20 0	14 4	21 0	14 4	20 10	12 11	21 0	13 0	253 7	36 3
	2	Cross short horn	6	Feb. 15	1,177¼	14 13	10 0	18 0	9 8	15 4	9 0	14 8	10 13	15 1	9 12	16 3	9 5	16 0	9 0	174 14	25 0
	3	Cross short-horn	8	April 13	831½	14 6	9 10	16 15	9 7	15 2	10 0	14 10	9 8	15 2	8 15	14 10	9 0	14 14	9 0	171 3	24 7
	4	Cross short horn	6	May 20	1,094½	24 12	17 11	25 3	17 12	26 4	18 9	27 4	16 12	27 0	19 1	25 9	18 4	26 [illegible]	16 8	206 5	43 12
	5	Cross short horn	7	April 17	1,110½	20 0	13 2	20 10	12 8	20 7	12 14	20 0	13 10	20 7	11 12	20 3	11 2	1 11	12 6	227 12	32 9
				Totals	5,264	98 13	63 15	105 6	64 1	100 12	63 14	96 1	64 15	98 10	63 12	96 12	60 6	98 6	59 14	1,136 9	—
				Means	1,053	19 12	12 12	20 11	12 13	20 2	12 12	19 3	13 0	19 12	12 12	19 6	12 1	19 11	12 0	226 11	32 6

Ten Cows.—Sewaged Meadow Grass.

	Cows. Nos.	Breed	Years old	Dates of Calving	Weights (May 25) lbs.	Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	Total in 7 days.	Per head per day.
Grass consumed. From which Field, Plot, and Crop						Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		Ten-acre, Plot 3, Crop 1		Ten-acre, Plot 3, Crop 1.		Ten-acre, Plot 2, Crop 1		Ten-acre, Plot 2, Crop 1		—	—
Quantities weighed (*tons. cwts. qrs. lbs.*)						0 11 2 2		0 9 1 18		0 17 0 9		0 12 1 25		0 5 2 7		0 14 3 8		0 14 3 13		4 5 2 21	0 1 0 25
Yield of Milk, &c.	1	Cross short horn	Aged	Mar. 10	1,136	17 3	13 9	17 10	12 11	17 12	12 6	17 12	15 11	18 0	13 10	18 7	12 6	16 8	10 16	212 7	30 6
	2	Cross short horn	Aged	April 7	1,010	21 3	13 6	22 4	13 14	21 11	14 2	22 1	14 8	23 1	14 2	22 0	12 4	20 10	13 0	245 4	35 7
	3	Cross short horn	6	Feb. 20	1,060	16 8	11 12	16 6	11 14	16 3	11 15	16 0	12 0	15 7	12 15	16 1	11 6	16 0	11 14	196 11	28 3
	4	Cross short horn	7	Feb. 15	980	16 0	10 11	14 15	10 14	15 10	10 11	16 4	11 2	16 10	11 0	16 2	9 7	15 0	9 8	183 14	26 4
	5	Ayrshire -	5	Feb. 22	984	13 11	10 10	14 7	10 8	15 3	10 5	14 8	11 7	16 2	9 8	15 2	10 7	13 4	8 12	173 14	24 13
	6	Cross short horn	6	April 14	936	19 11	12 10	20 4	12 6	19 0	13 12	20 10	13 7	21 0	13 0	21 0	11 2	18 2	11 8	227 14	32 9
	7	Mongrel - -	Aged	April 12	888	17 4	10 15	17 3	10 12	17 13	11 6	16 0	12 3	20 12	12 3	19 2	11 0	16 0	9 14	204 7	29 3
	8	Cross short horn	6	April 30	1,020	12 11	15 11	13 5	16 1	13 0	15 10	10 13	16 2	10 8	14 14	10 4	10 1	10 7	10 2	179 9	25 11
	9	Cross short-horn	7	April 13	954	18 6	12 10	18 5	14 10	17 4	15 0	18 12	13 0	17 12	13 13	18 1	11 8	20 0	10 9	219 12	31 6
	10§	Half short horn	Aged	Oct. 30	1,358	9 3	5 10	10 6	6 14	10 11	6 8	11 3	6 13	10 12	7 0	9 2	1 10	8 6	4 1	106 2	15 7
				Totals	10,312	161 3	117 10	165 3	120 6	164 3	121 11	168 4	124 14	170 6	122 0	163 5	101 8	154 5	100 3	1,954 14	—
				Means	1,031	16 2	11 12	16 8	12 1	16 7	12 3	10 10	12 6	17 1	12 8	16 6	10 9	16 7	10 0	195 8	27 15

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

	Cows. Nos.	Breed	Years old	Dates of Calving	Weights (May 25) lbs.	Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	Total in 7 days.	Per head per day.
Grass consumed. From which Field, Plot, and Crop						Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		—	—
Quantities weighed (*tons. cwts. qrs. lbs.*)						0 7 1 23		0 7 1 9		0 7 2 7		0 11 0 23		0 4 3 25		0 6 3 26		0 6 3 25		2 13 1 26	0 1 3 0
Yield	[illegible]	Cross short-horn	Aged	April 20	1,122	26 6	16 8	28 10	21 0	28 4	17 0	28 6	20 12	28 0	18 10	27 3	18 4	26 10	16 0	325 0	46 6
	[illegible]	Ayrshire - -	6	Mar. 15	902	19 9	11 6	19 11	13 0	20 0	16 0	20 1	13 2	19 13	11 15	19 5	9 13	19 0	13 9	220 4	31 7
	[illegible]	Cross short-horn	Aged	Mar. 1	1,108	18 13	10 1	16 11	10 6	17 0	11 0	16 0	10 11	17 0	9 10	17 0	10 8	17 0	9 12	189 14	27 0
	[illegible]	Cross short-horn	Aged	April 15	1,170	23 10	13 14	25 1	14 12	22 13	15 9	23 6	14 10	22 0	19 12	23 0	13 10	23 2	15 2	241 7	37 6

Five Cows.—Unsewaged Meadow Grass.

Cows. No.	Breed.	Years old.	Dates of Calving.	Weights (May 25) lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	Monday. A.M.	Monday. P.M.	Totals in 7 days.	Per head per day.
Grass consumed. From which Field, Plot, and Crop					Ten-acre, Plot 0*, Crop 1.		Ten-acre, Plot 0*, Crop 1.		Ten-acre, Plot 0*, Crop 1.		Ten-acre, Plot 0*, Crop 1.		Ten-acre, Plot 0*, Crop 1.		Ten-acre, Plot 0*, Crop 1.		Ten-acre, Plot 0*, Crop 1.		—	—
Quantities weighed (tons. cwts. qrs. lbs.)					0 9 3 4		0 6 0 5		0 9 0 17		0 8 2 2		0 5 0 10		0 5 1 7		0 5 1 7		3 9 3 24	0 11 1 20
Yield of Milk, &c.					lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.
1	Cross short-horn	Aged	May 1	1,087	19 13	13 11	21 6	14 1	20 1	12 4	19 0	12 12	19 8	13 7	19 9	13 4	19 2	13 8	[illegible] 14	[illegible] 14
2	Cross short-horn	6	Feb. 15	1,177	18 0	10 2	15 2	9 5	14 0	9 8	13 4	9 5	14 8	9 11	13 0	9 6	18 13	9 0	162 14	32 4
3	Cross short-horn	3	April 12	821	14 6	9 4	14 18	9 10	14 6	6 0	12 6	8 6	18 8	8 12	13 11	6 7	14 6	8 9	160 8	22 14
4	Cross short-horn	8	May 20	1,084	24 6	19 1	26 2	17 6	23 4	17 9	22 0	16 15	23 12	17 6	22 4	16 4	22 4	15 6	285 12	40 13
5	Cross short-horn	7	April 17	1,110	19 6	12 4	20 0	12 6	20 4	13 1	19 7	12 0	19 12	12 0	20 6	11 10	20 1	11 8	238 8	31 14
			Totals	[illegible]	91 9	64 6	97 6	62 12	92 1	59 15	87 3	60 6	90 12	60 14	89 14	57 15	90 10	56 10	1,062 0	—
			Means	1,059	18 4	12 14	19 8	12 9	18 6	12 0	17 7	12 1	18 2	12 3	18 0	11 9	18 2	11 5	212 6	30 5

Ten Cows.—Sewaged Meadow Grass.

Cows. No.	Breed.	Years old.	Dates of Calving.	Weights (May 25) lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	Totals in 7 days.	Per head per day.
Grass consumed. From which Field, Plot, and Crop					Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		Ten-acre, Plot 2, Crop 1.		—	—
Quantities weighed (tons. cwts. qrs. lbs.)					0 11 0 21		0 12 3 21		0 11 3 1		0 12 2 0		0 13 3 25		0 9 3 17		0 9 0 19		4 2 0 20	0 1 0 20
1	Cross short-horn	Aged	Mar. 10	1,136	17 3	12 8	16 7	11 10	15 10	10 9	14 10	9 7	15 0	10 0	14 14	10 1	14 16	10 4	192 12	29 5
2	Cross short-horn	Aged	April 7	1,010	21 0	14 0	21 10	12 14	20 2	13 2	19 0	13 6	16 0	12 10	18 2	11 0	18 12	11 6	225 0	32 2
3	Cross short-horn	5	Feb. 20	1,080	16 8	10 8	15 13	12 6	15 12	10 8	14 12	12 4	14 2	11 12	14 0	11 6	14 6	9 11	189 9	24 4
4	Cross short-horn	7	Feb. 15	940	14 1	10 4	15 0	9 12	14 2	10 9	15 10	10 8	14 14	10 6	15 6	9 13	15 0	9 8	174 6	24 14
5	Ayrshire	8	Feb. 28	884	14 0	9 11	13 2	10 8	14 4	10 0	13 12	9 7	13 0	10 10	13 6	9 2	14 4	8 14	164 1	23 7
6	Cross short-horn	6	April 14	956	18 8	12 11	19 6	11 7	16 0	12 2	17 13	12 8	19 1	11 0	17 6	11 7	18 0	11 4	210 6	30 0
7	Mongrel	Aged	April 12	838	10 0	11 4	17 1	10 9	16 6	10 4	17 0	10 2	15 6	11 2	16 0	9 4	15 8	9 1	184 12	26 6
8	Cross short-horn	6	April 16	1,026	10 2	14 5	10 6	13 14	11 12	13 2	9 11	12 9	9 4	12 4	10 12	10 0	11 8	10 14	160 7	22 15
9	Cross short-horn	7	April 13	984	16 7	14 8	18 4	12 3	17 2	13 10	16 12	12 6	17 4	11 10	17 10	11 2	18 0	11 8	209 0	29 14
10	Half short-horn	Aged	Oct. 20	1,346	6 4	5 0	6 6	5 13	7 0	5 10	7 6	6 2	8 12	5 15	8 10	6 0	8 1	6 1	93 15	13 4
			Totals	10,312	140 13	114 1	154 1	110 14	150 4	109 6	146 6	105 11	144 11	107 5	146 14	90 5	147 13	84 7	1,736 15	—
			Means	1,031	[illegible] 0	11 6	15 7	11 1	15 0	10 15	14 10	10 14	14 8	10 12	14 9	9 15	14 13	8 14	173 11	25 8

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Cows. No.	Breed.	Years old.	Dates of Calving.	Weights (May 25) lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	Totals in 7 days.	Per head per day.
Grass consumed. From which Field, Plot, and Crop					Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye, Plot 3, Crop 2.		Rye, Plots 2 & 3, Crop 2.		Rye, Plot 2, Crop 2.		Rye, Plot 2, Crop 2.		Rye, Plot 2, Crop 2.		—	—
Quantities weighed (tons. cwts. qrs. lbs.)					0 9 3 25		0 6 0 15		0 6 3 8		0 11 0 10		0 7 2 19		0 6 1 25		0 8 1 20		2 15 2 9	0 1 2 19
1	Cross short-horn	Aged	April 20	1,123	26 10	18 1	27 1	15 5	26 0	18 5	25 4	16 14	26 0	16 12	26 0	16 3	23 0	14 5	295 12	42 4
2	Ayrshire	6	Mar. 15	902	19 0	13 5	20 5	13 3	19 14	12 1	16 11	11 0	17 12	13 4	19 10	11 0	19 6	10 9	218 12	31 4
3	Cross short-horn	Aged	Mar. 1	1,105	17 0	10 11	16 15	9 0	14 4	10 11	15 0	10 2	13 3	9 11	15 4	9 5	15 0	9 5	177 11	25 6
4	Cross short-horn	Aged	April 13	1,176	23 3	16 3	22 4	15 0	23 15	14 12	22 0	12 10	22 5	14 14	21 12	15 2	24 0	15 5	257 11	36 12
5	Cross short-horn	6	Jan. 2	1,048	13 1	9 8	14 10	8 12	13 2	9 14	13 14	8 14	13 12	8 12	13 6	8 12	14 8	7 14	176 12	22 6
			Totals	5,354	97 13	67 10	101 5	61 10	97 3	61 11	93 13	50 8	94 1	63 5	90 0	58 4	95 1	55 0	1,108 10	-

Table X.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on Unsewaged and Sewaged Meadow Grass, and on Italian Rye Grass (without Oilcake).

Third Season, 1863; 7 days.—June 16 to June 22.

FIVE COWS.—UNSEWAGED MEADOW GRASS.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop				Five-acre, Plot 0,* Crop 1.		Five-acre, Plot 0,* Crop 1.		Five-acre, Plot 0,* Crop 1.		—		Five-acre, Plot 0,* Crop 1.		Five-acre, Plot 0,* Crop 1.		Five-acre, Plot 0*, Crop 1.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)				0 5 3 17½		0 6 3 0½		0 7 2 8½		—		0 5 0 22½		0 0 0 0½		0 5 3 27		1 15 1 20½	0 1 0 1
Yield of Milk, &c. Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (June 22). lbs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross short-horn	Aged	May 1	1,078	19 7	12 4	20 8	12 13	20 4	12 11	21 4	12 10	20 8	12 14	20 0	12 10	20 4	12 8	230 4	32 14
2	Cross short-horn	6	Feb. 15	1,100	13 5	10 3	13 0	10 4	12 14	10 9	13 11	10 0	13 7	10 1	13 8	8 13	13 5	9 7	159 14	22 13
3	Cross short-horn	8	April 13	894	13 12	8 4	14 9	8 10	14 7	8 13	14 7	8 8	13 4	8 12	14 1	8 0	14 3	8 4	156 4	22 5
4	Cross short-horn	8	May 20	1,089	22 2	16 10	23 1	16 12	23 0	16 12	23 4	17 6	21 4	16 11	22 15	16 2	21 6	15 6	273 13	39 2
5	Cross short-horn	7	April 17	1,097	19 7	10 9	20 14	11 4	19 8	11 12	19 11	11 2	18 8	12 2	19 4	10 0	20 8	10 11	215 4	30 12
			Totals	5,238	88 1	57 14	90 2	59 13	90 1	60 0	92 5	59 10	86 15	60 8	89 12	53 11	90 7	56 4	1,035 7	—
			Means	1,048	17 10	11 9	18 0	11 15	18 0	12 0	18 7	11 15	17 6	12 2	17 15	10 12	18 1	11 4	207 1	29 9

TEN COWS.—SEWAGED MEADOW GRASS.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop				Five-acre, Plot 2, Crop 1.		Five-acre, Plot 2, Crop 1.		Five acre, Plot 2, Crop 1.		Ten-acre, Plot 3, Crop 1.		Ten-acre, Plot 4, Crop 2.		Five-acre, Plot 4, Crop 2.		Five-acre, Plot 4, Crop 2.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)				0 12 3 17		0 5 1 6		0 7 2 10		0 12 1 6		0 15 1 25		0 9 1 27		0 9 2 6		3 12 [illegible] 1	0 1 0 4
Yield of Milk, &c. 1	Cross short-horn	Aged	Mar. 10	1,121	13 4	10 3	15 0	11 4	14 14	11 7	14 7	11 11	14 5	11 14	14 4	10 10	14 6	9 8	177 1	25 5
2†	Cross short-horn	6	June 15	1,264	17 0	10 13	18 13	13 0	18 0	12 11	19 5	12 7	18 10	13 6	19 0	10 0	16 4	9 0	200 0	28 14
3	Cross short-horn	6	Feb. 20	1,083	13 1	11 0	13 2	12 0	13 3	12 2	13 7	10 7	13 2	11 0	13 8	9 4	13 5	8 6	166 15	23 13
4	Cross short-horn	7	Feb. 15	986	13 6	9 6	14 0	10 0	14 2	10 0	14 1	10 0	13 10	10 2	14 7	8 8	14 4	8 0	163 14	23 7
5	Ayrshire	9	Feb. 22	1,060	14 8	9 10	11 1	9 12	14 8	9 14	14 10	10 1	13 11	9 5	13 12	8 0	13 0	8 1	167 13	23 4
6	Cross short-horn	6	April 14	958	17 0	11 0	16 12	12 1	17 0	13 15	16 11	11 4	16 7	11 3	16 0	10 4	15 0	10 8	195 15	27 15
7	Mongrel	Aged	April 12	894	15 4	9 6	15 2	9 9	14 8	9 10	15 4	10 5	14 10	9 8	14 0	7 6	12 0	7 6	164 2	23 7
8	Cross short-horn	6	April 16	1,088	10 0	12 6	11 3	12 3	9 0	12 15	10 0	9 12	12 0	11 15	11 11	8 6	11 4	6 2	151 3	21 10
9	Cross short-horn	7	April 13	904	17 1	10 15	17 14	10 13	17 11	12 8	18 0	11 2	17 6	12 14	16 0	9 4	16 12	11 10	199 14	28 9
10‡	Half short-horn	6	April 25	1,180	8 4	6 0	8 4	6 13	8 12	6 4	8 10	7 0	8 2	6 8	6 0	6 0	8 4	6 1	103 7	14 12
			Totals	10,533	139 2	100 11	144 5	107 7	149 3	110 6	144 7	103 15	141 15	107 13	141 9	87 10	134 7	80 8	1,588 4	—
			Means	1,053	13 15	10 1	14 7	10 12	14 6	11 1	14 7	10 6	14 3	10 13	14 2	8 12	13 7	8 10	158 4	22 11

FIVE COWS.—UNSEWAGED OR SEWAGED ITALIAN RYE GRASS.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop				Rye, Plot 2, Crop 2.		Rye, Plot 2, Crop 2.		Rye, Plot 2, Crop 2.		Rye, Plot 2, Crop 2.		Rye, Plot 2, Crop 2.		Rye, Plot 2, Crop 2.		Rye, Plot 2, Crop 2.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)				0 6 2 26		0 12 0 19		0 6 0 23		0 6 1 15		0 6 1 15		0 7 1 0		0 7 1 14		2 14 2 0	0 1 2 7
Yield of Milk, &c. 1	Cross short-horn	Aged	April 20	1,122	23 6	14 6	25 6	17 14	27 0	16 2	23 3	10 10	23 14	17 0	22 10	14 2	21 0	14 11	279 12	39 15
2	Ayrshire	6	Mar. 15	878	17 11	11 6	18 10	11 9	10 1	11 14	19 13	11 10	18 10	11 2	17 11	9 4	17 0	9 14	204 8	29 3
3	Cross short-horn	Aged	Mar. 1	1,087	14 5	10 0	15 4	10 0	14 15	0 11	14 4	10 8	14 12	9 5	14 15	8 5	15 6	8 4	171 6	24 8
4	Cross short-horn	Aged	April 15	1,180	19 5	13 12	20 10	13 6	21 3	12 2	21 2	13 10	20 0	12 14	20 2	12 14	20 6	12 7	236 12	33 13
5	Cross short-horn	6	Jan. 2	1,126	14 3	8 6	15 6	10 3	13 10	8 15	16 6	10 3	15 1	8 6	13 8	8 2	13 0	9 0	158 9	21 13

Five Cows.—Unsewaged Meadow Grass.

Grass consumed.	From which Field, Plot, and Crop					Ten acre, Plot 0*, Crop 1.		Five-acre, Plot 0*, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)					0 12 2 22		0 4 0 4		0 2 3 23¼		0 4 0 1¼		0 4 2 7¼		0 2 1 22½		0 2 1 26		1 13 0 23	0 0 3 22
Yield of Milk, &c.	Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (June 22) *lbs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	— *lbs. ozs.*	— *lbs. ozs.*
	1	Cross short-horn	Aged	May 1	1,078	19 1	12 10	19 0	12 6	19 3	12 0	18 1	11 4	18 1	12 8	19 4	11 0	18 10	10 18	213 13	30 9
	2	Cross short-horn	6	Feb. 15	1,190	12 2	9 12	13 3	9 5	13 5	9 1	12 12	9 3	13 0	8 1	12 10	7 12	12 8	8 0	150 10	21 8
	3	Cross short-horn	3	April 13	804	13 2	8 9	13 8	8 12	13 4	8 2	12 10	8 0	12 0	7 11	12 8	7 3	12 8	7 6	145 8	20 12
	4	Cross short-horn	8	May 20	1,009	21 6	14 14	22 14	15 6	23 0	16 3	21 4	16 14	20 8	15 9	22 0	13 0	23 0	14 12	260 10	37 4
	5	Cross short-horn	7	April 17	1,097	18 3	11 14	19 10	11 0	18 0	11 12	18 2	11 0	18 6	11 7	18 12	10 1	19 6	10 10	207 3	29 9
				Totals	5,233	83 14	57 11	87 3	56 13	86 12	57 2	82 13	56 5	81 15	53 4	85 2	49 0	86 0	51 9	977 7	—
				Means	1,048	16 12	11 9	17 7	11 6	17 6	11 7	16 9	11 4	16 6	11 1	17 0	9 13	17 3	10 5	195 8	27 15

Ten Cows.—Sewaged Meadow Grass.

Grass consumed.	From which Field, Plot, and Crop					Five-acre, Plot 4, Crop 2.		Five-acre, Plot 3, Crop 2.		Five-acre, Plot 3, Crop 2.		Ten-acre, Plot 3, Crop 2.		Ten-acre, Plot 5, Crop 2.		Ten-acre, Plot 3, Crop 2.		Ten-acre, Plot 3, Crop 2.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)					0 13 2 1		0 14 3 19		0 13 1 18		0 11 2 10		0 9 0 25		0 12 1 22		0 12 1 27		4 7 2 10	0 1 1 0
Yield of Milk, &c.	1	Cross short horn	Aged	Mar. 10	1,121	13 4	10 4	15 4	10 8	16 1	10 3	14 0	11 14	14 14	12 0	16 4	11 8	16 12	10 14	183 10	26 4
	2	Cross short horn	8	June 15	1,280	13 8	9 10	18 5	13 11	18 6	13 14	18 5	13 11	21 0	16 8	22 6	14 2	23 8	15 4	232 2	33 3
	3	Cross short-horn	6	Feb. 20	1,066	13 0	9 11	14 2	10 4	14 8	10 0	15 6	10 6	12 8	12 3	14 2	10 3	14 14	11 11	172 9	24 10
	4	Cross short-horn	7	Feb. 15	996	12 2	8 1	13 6	9 0	13 4	7 13	12 7	8 10	12 0	8 12	14 3	8 6	14 6	9 3	151 9	21 10
	5	Ayrshire - -	8	Feb. 22	1,000	12 3	8 3	13 2	10 3	13 7	9 6	13 12	9 6	13 0	10 0	13 8	8 10	15 7	8 8	157 11	22 8
	6	Cross short-horn	6	April 14	958	15 8	11 10	17 6	10 7	18 4	10 0	17 12	10 6	18 4	11 13	18 7	9 9	16 14	11 6	197 10	28 4
	7	Mongrel - -	Aged	April 12	894	12 3	8 0	13 1	8 7	13 0	8 1	12 8	8 4	12 14	8 14	13 10	7 7	13 8	8 1	147 14	21 2
	8	Cross short-horn	6	April 16	1,068	10 2	11 14	10 7	11 12	10 7	8 5	10 11	8 12	11 10	8 12	10 8	9 8	11 14	8 14	143 8	20 8
	9	Cross short-horn	7	April 13	934	15 0	11 9	15 0	10 8	15 0	10 13	14 0	9 3	16 2	10 0	17 9	11 14	15 5	10 11	182 10	26 2
	10	Half short-horn	8	April 25	1,186	23 3	16 0	22 9	14 2	22 6	15 0	19 0	16 2	21 0	18 1	23 8	13 4	23 12	14 2	203 1	37 7
				Totals	10,533	140 1	104 14	152 10	108 14	154 6	103 7	146 13	106 10	153 4	110 15	164 1	104 7	166 4	108 10	1,831 4	—
				Means	1,053	14 0	10 8	15 4	10 14	15 7	10 5	14 11	10 11	15 5	11 11	16 7	10 7	16 10	10 14	183 2	26 3

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Grass consumed.	From which Field, Plot, and Crop					Rye, Plot 2, Crop 2.		Rye, Plot 2, Crop 2.		Rye, Plot 2, Crop 2, & Plot 3, Crop 3.		Rye, Plot 3, Crop 3.		Rye, Plot 3, Crop 3.		Rye, Plot 3, Crop 3.		Rye, Plot 3, Crop 3.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)					0 6 1 0		0 8 2 2		0 6 2 25		0 5 0 19		0 9 0 23		0 5 3 2		0 5 3 7		2 7 1 13	0 1 1 12
Yield of Milk, &c.	1	Cross short-horn	Aged	April 20	1,123	21 6	15 0	23 12	14 5	22 0	14 6	22 0	14 10	20 0	13 7	20 8	13 6	23 9	12 12	231 1	35 14
	2	Ayrshire - -	6	Mar. 15	878	16 4	10 5	17 3	10 10	17 0	11 4	16 0	10 12	17 10	10 0	16 12	9 4	17 2	10 11	190 13	27 4
	3	Cross short-horn	Aged	Mar. 1	1,087	14 8	10 0	14 15	9 10	15 3	9 1	15 1	10 2	15 0	9 8	14 6	8 9	15 10	7 15	160 8	21 8
	4	Cross short-horn	Aged	April 15	1,180	20 5	13 0	19 11	12 0	19 8	13 10	20 4	13 0	18 14	12 4	18 13	12 7	20 0	11 7	224 14	32 2
	5	Cross short-horn	6	Jan. 2	1,128	12 1	8 12	11 4	8 6	11 12	8 0	12 4	8 1	11 12	6 13	12 0	8 0	12 7	7 2	138 10	19 13
				Totals	5,395	84 3	57 1	86 13	54 15	85 7	56 5	85 9	56 9	83 4	52 0	82 7	51 10	88 12	49 15	974 14	—
				Means	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table X.—continued.

Record of Food consumed, and Milk yielded, by Cows fed on Unsewaged and Sewaged Meadow Grass, and on Italian Rye Grass (without Oilcake).

Third Season, 1863; 7 days.—June 30 to July 6.

Five Cows.—Unsewaged Meadow Grass.

					Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Monday		Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop				Ten acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten acre, Plot 1, Crop 1.		Ten acre, Plot 1, Crop 1		Ten-acre, Plot 1, Crop 1		Ten-acre, Plot 1, Crop 1		Ten-acre, Plot 1, Crop 1.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)				0 4 3 6½		0 2 2 21½		0 4 1 25½		0 6 0 10		0 5 3 10½		0 4 1 13½		0 4 0 1		1 13 1 4½	0 0 3 19
Yield of Milk, &c. Cows. Nos.	Breed.	Years old.	Dates of Calving	Weights (June 22) *lbs.*	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*
1	Cross short-horn	Aged	May 1	1,078	18 2	10 14	18 2	10 12	17 11	10 8	18 2	11 12	17 8	7 3	18 6	11 0	18 5	10 0	186 13	26 6
2	Cross short horn	6	Feb. 15	1,190	13 3	7 3	13 0	8 4	12 7	7 10	12 10	8 2	12 7	7 9	13 4	7 1	13 8	7 14	144 12	20 11
3	Cross short horn	5	April 13	904	12 7	7 9	11 2	7 10	12 13	7 14	12 14	8 3	19 10	11 3	15 8	7 12	12 12	7 5	147 2	21 0
4	Cross short-horn	8	May 20	1,059	22 5	15 0	21 11	14 15	21 7	14 2	22 6	14 8	21 11	14 10	23 3	12 10	22 14	15 14	257 4	36 12
5	Cross short-horn	7	April 17	1,067	18 0	10 8	18 10	10 4	16 0	11 0	17 0	10 12	18 9	11 13	18 2	12 1	17 12	9 0	199 0	28 7
			Totals	5,238	84 1	51 12	84 9	51 12	80 6	51 3	83 0	53 5	82 6	52 6	86 1	50 8	85 3	50 7	946 15	—
			Means	1,048	16 13	10 6	16 14	10 6	16 1	10 4	16 9	10 11	16 7	10 8	17 3	10 2	17 1	10 1	189 6	27 1

Ten Cows.—Sewaged Meadow Grass.

					Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Monday		Total in 7 days.	Per head per day.
Grass consumed	From which Field, Plot, and Crop				Five acre, Plot 3, Crop 2		Five-acre, Plot 3, Crop 2		Five acre, Plot 3, Crop 2.		Ten-acre, Plot 3, Crop 2		Ten-acre, Plot 3, Crop 2		Ten-acre, Plot 3, Crop 2.		Ten-acre, Plot 3, Crop 2		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)				0 16 3 23		0 17 3 18		0 16 3 27		0 12 0 0		0 15 1 21		0 13 2 19		0 13 2 15		5 6 2 7	0 1 2 9
Yield of Milk, &c.																				
1	Cross short-horn	Aged	Mar. 10	1,121	15 10	11 13	17 6	12 9	17 3	12 5	17 12	11 6	16 4	13 7	17 8	9 14	15 7	12 0	190 8	26 8
2	Cross short horn	8	June 15	1,290	21 4	15 4	22 8	13 2	22 0	15 14	22 12	16 8	22 6	16 8	23 4	14 6	22 10	14 0	267 6	38 3
3	Cross short horn	8	Feb. 20	1,056	14 1	12 6	14 5	12 10	14 1	11 10	13 11	11 7	15 7	11 2	13 0	10 0	12 7	11 7	175 10	25 2
4	Cross short-horn	7	Feb. 13	906	12 10	8 14	14 5	8 15	14 0	9 6	14 0	9 13	14 0	9 12	15 0	9 4	14 3	9 8	164 6	23 6
5	Ayrshire	8	Feb. 23	1,000	13 4	9 7	15 4	8 11	14 13	10 2	13 10	9 8	13 4	9 12	13 12	9 3	14 4	9 11	164 9	23 8
6	Cross short-horn	9	April 14	958	17 2	12 3	14 0	12 3	17 15	11 7	18 14	12 0	17 11	11 9	17 2	10 5	18 0	11 9	201 6	29 5
7	Mongrel	Aged	April 12	824	12 13	9 2	14 4	8 5	14 0	9 4	14 0	9 11	14 12	9 5	13 0	8 0	14 10	9 4	162 4	23 3
8	Cross short horn	9	April 16	1,088	11 2	9 6	11 8	9 12	12 5	9 2	11 4	10 0	11 0	9 10	11 0	9 8	13 0	8 9	146 2	20 14
9	Cross short horn	7	April 13	914	10 0	11 11	16 9	10 7	17 15	11 6	15 11	13 11	16 1	14 12	15 6	11 10	16 8	10 4	189 1	28 7
10	Half short-horn	6	April 23	1,188	22 0	11 6	23 0	14 15	22 12	13 5	22 9	14 4	21 10	10 14	24 9	13 8	22 6	14 4	254 15	36 7
			Totals	10,533	155 14	114 8	168 15	114 7	167 0	115 15	164 5	117 10	160 7	113 11	164 9	105 10	169 7	112 8	1,869 5	—
			Means	1,053	15 9	11 7	16 14	11 7	16 11	11 10	16 7	11 12	16 1	11 9	16 7	10 9	16 4	11 4	186 15	27 11

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

					Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Monday		Total in 7 days.	Per head per day.
Grass consumed.	From which Field, Plot, and Crop				Rye, Plot 3, Crop 3.		Rye, Plot 3, Crop 3		Rye, Plot 3, Crop 3.		Rye, Plot 3, Crop 3.		Rye, Plot 3, Crop 3.		Rye, Plot 3, Crop 3.		Rye, Plot 3, Crop 3.			—
	Quantities weighed (*tons. cwts. qrs. lbs.*)				0 10 1 6		0 7 1 19		0 6 0 23		0 11 0 16		0 6 3 23		0 6 3 23		0 7 0 0		2 15 3 26	0 1 2 11
Yield																				
1	Cross short horn	Aged	April 30	1,122	21 8	13 13	22 0	15 5	22 6	14 0	22 2	14 1	22 0	13 12	21 8	13 14	21 8	13 12	252 2	36 0
2	Ayrshire	9	Mar. 15	873	17 7	11 2	19 8	10 0	16 12	11 0	17 13	11 4	16 14	11 2	18 0	10 5	17 11	10 7	203 13	29 2
3	Cross short horn	Aged	Mar. 1	1,047	14 1	9 0	14 11	9 9	14 12	10 1	15 8	9 12	14 4	9 10	14 14	8 15	14 10	9 7	164 5	23 7
4	Cross short-horn	Aged	April 15	1,160	19 1	13 0	19 9	13 0	19 1	12 14	18 6	11 8	17 0	14 6	18 0	11 4	19 12	10 7	215 4	30 12

Five Cows.—Unsewaged Meadow Grass.

Grass consumed.	From which Field, Plot, and Crop					—		—		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Ten-acre, Plot 1, Crop 1.		Five-acre, Plot 1, Crop 1.		Five-acre, Plot 1, Crop 1.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)					—		—		0 4 3 24½		0 3 1 3½		0 4 3 10½		0 1 1 17½		0 1 1 20		0 15 2 20	0 0 1 20
Yield of Milk, &c.	Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (June 22) *lbs.*	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
						lbs. ozs.	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*
	1	Cross short-horn	Aged	May 1	1,078	17 18	10 8	17 8	10 12	18 0	11 3	17 0	10 15	18 0	11 4	18 2	10 8	16 11	11 3	201 4	26 11
	2	Cross short horn	6	Feb. 15	1,180	12 7	8 6	12 11	8 6	12 7	8 10	12 10	8 2	12 12	8 9	12 7	7 10	13 11	7 8	146 9	30 16
	3	Cross short horn	5	April 13	924	13 8	7 13	13 0	7 14	13 13	7 15	12 10	7 14	13 5	7 12	13 2	7 9	18 10	8 6	143 13	30 13
	4	Cross short-horn	6	May 20	1,060	21 8	16 0	23 1	15 14	21 5	14 7	21 0	14 6	23 0	15 12	21 10	14 2	24 0	14 12	208 14	37 6
	5	Cross short-horn	7	April 17	1,097	16 6	10 4	17 8	10 6	18 2	11 2	17 4	11 3	18 4	10 11	18 15	10 5	19 5	10 12	200 2	28 9
				Totals	5,238	80 5	51 13	83 7	53 6	82 11	53 8	80 8	53 6	85 5	54 5	84 4	49 13	88 5	53 8	902 10	—
				Means	1,048	[illegible] 1	10 6	16 8	10 11	16 9	10 11	16 1	10 8	17 1	10 14	16 13	9 15	17 14	10 8	180 8	27 3

Ten Cows.—Sewaged Meadow Grass.

Grass consumed.	From which Field, Plot, and Crop					Five-acre, Plot 5, Crop 2.		Five-acre, Plot 5, Crop 2.		Five-acre, Plot 3, Crop 2.		Ten-acre, Plot 3, Crop 2.		Ten-acre, Plot 3, Crop 2.		Five-acre, Plot 2, Crop 2.		Five-acre, Plot 2, Crop 2.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)					0 14 3 18		0 18 1 18		0 18 1 18		0 19 3 20		1 0 2 4		0 12 1 2		0 12 1 7		5 14 2 21	0 1 2 16
Yield of Milk, &c.	1	Cross short-horn	Aged	Mar. 10	1,121	15 6	12 14	16 0	13 2	17 4	11 3	16 6	12 8	17 0	12 9	16 10	12 0	17 0	11 7	201 0	28 11
	2	Cross short-horn	6	June 15	1,280	23 4	16 8	22 2	17 0	23 0	16 11	21 12	15 10	22 6	16 12	23 6	15 1	23 3	15 9	272 9	38 14
	3	Cross short-horn	6	Feb. 20	1,066	13 0	11 8	13 4	9 12	13 8	11 1	12 5	11 12	13 10	11 10	14 7	10 2	15 12	9 14	109 4	24 8
	4	Cross short-horn	7	Feb. 15	996	14 6	9 3	14 0	11 5	14 5	10 4	13 0	9 1	14 6	9 14	14 5	8 8	14 4	8 4	105 1	26 9
	5	Ayrshire - -	8	Feb. 22	1,000	14 10	9 8	14 3	10 4	14 4	9 4	13 8	9 1	14 7	10 8	14 4	9 2	14 12	9 0	103 6	23 13
	6	Cross short horn	6	April 14	958	16 8	10 15	17 13	11 10	18 1	10 0	16 3	12 8	16 0	11 3	18 9	10 10	18 2	10 5	202 0	26 14
	7	Mongrel -	Aged	April 12	894	14 2	5 14	14 2	10 2	15 0	11 10	14 0	9 0	14 5	9 13	15 0	8 12	14 1	8 4	172 1	24 9
	8	Cross short-horn	6	April 16	1,006	12 0	10 0	11 13	9 13	11 4	9 10	11 10	10 4	12 9	9 12	13 0	9 0	13 2	9 10	138 7	31 13
	9	Cross short horn	7	April 18	964	17 12	11 7	17 9	12 7	17 0	12 6	14 0	12 6	16 8	11 6	15 6	10 4	15 3	13 1	198 13	28 6
	10	Half short-horn	6	April 25	1,186	21 4	15 15	22 0	15 3	22 12	17 4	16 11	17 9	21 9	16 4	20 1	15 0	21 13	15 0	229 11	27 9
				Totals	10,533	164 6	116 5	163 14	120 10	169 4	119 5	158 7	119 6	164 0	119 11	164 11	108 7	166 3	110 6	1,938 15	—
				Means	1,053	16 7	11 10	16 6	12 1	16 15	11 15	15 5	11 15	16 6	11 15	16 7	10 14	[illegible] 10	11 1	195 14	28 0

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Grass consumed.	From which Field, Plot, and Crop					Rye, Plot 5, Crop 3.		Rye, Plot 3, Crop 3.		Rye, Plot 9, Crop 3.		Rye, Plot 5, Crop 3.		Rye, Plot 2, Crop 3.		Rye, Plot 3, Crop 3.		Rye, Plot 3, Crop 3.		—	—
	Quantities weighed (*tons. cwts. qrs. lbs.*)					0 9 0 23		0 14 0 23		0 5 2 23		0 7 2 24		0 9 0 5		0 7 3 1		0 7 3 1		3 1 1 15	0 1 3 0
Yield of Milk, &c.	1	Cross short-horn	Aged	April 20	1,159	21 6	13 14	21 12	12 14	21 14	13 0	20 5	13 11	21 2	13 7	21 4	12 3	23 10	14 3	245 7	35 1
	2	Ayrshire - -	6	Mar. 15	874	17 9	12 0	17 2	9 6	17 0	10 15	17 1	10 9	16 12	10 0	16 3	9 8	17 7	10 6	191 12	27 0
	3	Cross short-horn	Aged	Mar. 1	1,067	18 1	8 8	15 3	9 3	14 14	8 13	14 3	8 15	13 6	8 13	14 2	8 14	14 6	9 7	169 1	24 3
	4	Cross short-horn	Aged	April 15	[illegible]	17 [illegible]	13 7	17 12	12 0	16 0	13 2	19 7	11 6	19 8	11 14	20 8	11 10	20 1	11 8	217 8	31 1
	5	Cross short-horn	6	Jan. 2	1,124	12 1	8 9	11 4	9 0	12 6	8 4	13 0	8 14	13 6	7 10	12 0	8 3	12 10	8 4	147 9	21 1
				Totals	[illegible]	85 13	55 6	85 8	52 11	84 2	54 1	83 14	53 7	88 4	51 12	84 1	50 8	88 2	53 12	971 5	
				Means	1,079	17 3	11 1	17 2	10 9	16 13	10 13	16 12	10 11	17 10	10 6	16 13	10 1	17 10	10 12	194 4	27 12

Table X.—continued.

Detailed Record of Food [redacted] and Milk yielded, by Cows fed on Unsewaged and Sewaged Meadow Grass, and on Italian Rye Grass, with Oilcake in addition.
Third Season, 1868; 7 days.—September 22 to September 28.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
FIVE COWS.—UNSEWAGED MEADOW GRASS.																				
Food consumed. Grass	From which Field, Plot, and Crop				Five-acre, Plot 0*, Crop 2.		Five-acre, Plot 1, Crop 2.		Five-acre, Plot 1, Crop 2		Five acre, Plot 1, Crop 2.		—		Ten acre, Plot 1, Crop 2.		Ten-acre, Plot 1, Crop 2.		—	—
	Quantities weighed (tons. cwts. qrs. lbs.)				0 2 1 12		0 4 1 14½		0 2 2 10½		0 2 1 9		—		0 3 0 16		0 3 0 21		1 15 0 20½	0 1 0 1
Oilcake	(3 parts cotton & 2 parts rape cake) (ditto)				0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 1 2 7	0 0 0 5
Cows Nos.	Breed.	Years old.	Dates of Calving	Weights (Sept. 14) lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
Yield of Milk, &c.					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross short horn	Aged	May 1	1,304†	20 8	12 13	21 8	13 13	20 12	11 15	21 6	13 7	20 8	12 12	20 4	11 0	20 6	13 14	233 13	33 6
2	Cross short horn	6	Feb. 15	1,272†	11 0	6 11	10 6	7 3	11 0	5 7	11 0	6 10	10 12	8 0	10 0	6 1	11 8	6 8	124 2	17 12
3	Cross short-horn	3	April 13	860†	13 14	8 11	14 11	8 15	14 0	8 11	14 6	9 10	14 7	9 6	14 7	8 8	14 4	9 10	163 8	23 6
4	Cross short horn	5	May 20	1,086†	21 12	14 14	22 6	13 11	22 3	14 4	22 10	18 10	21 11	14 11	21 8	9 12	23 1	14 10	250 13	35 13
5	Cross short horn	7	April 17	1,344†	17 3	10 2	18 1	9 14	17 2	9 2	17 15	10 6	17 3	9 10	17 2	12 4	17 2	9 11	192 11	27 8
			Totals	5,707	84 5	55 9	87 2	55 5	85 1	49 7	87 3	55 11	84 9	54 7	83 5	49 9	86 5	53 8	964 15	—
			Means	1,141	16 14	10 10	17 7	10 11	17 0	9 14	17 7	10 12	16 15	10 14	16 10	9 15	17 4	10 11	193 0	27 9
TEN COWS.—SEWAGED MEADOW GRASS.																				
Food consumed. Grass	From which Field, Plot, and Crop				Five-acre, Plot 4, Crop 4		Five-acre, Plot 4, Crop 4.		Five acre, Plot 4, Crop 4.		Five-acre, Plot 4, Crop 4.		Ten-acre, Plot 2, Crop 3.		Ten-acre, Plot 2, Crop 3.		Ten acre, Plot 2, Crop 3.		—	—
	Quantities weighed (tons. cwts. qrs. lbs.)				0 14 1 0		0 16 3 21		1 1 0 24		0 17 2 24		0 17 1 6		0 10 1 16		0 10 1 12		5 8 0 19	0 1 3 5
Oilcake	(3 parts cotton & 2 parts rape cake) (ditto)				0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 3 0 14	0 0 0 5
1	Cross short-horn	Aged	Mar. 10	1,306	15 0	10 3	14 15	10 12	15 0	10 3	14 12	10 12	14 8	10 13	14 2	9 10	15 1	10 7	170 2	23 5
2	Cross short horn	8	June 15	1,304	16 10	11 6	17 12	11 11	17 10	11 0	16 6	11 10	18 7	11 11	17 5	11 6	16 5	11 8	205 7	29 5
3	Cross short horn	6	Feb. 20	1,174	12 1	8 8	12 0	8 0	12 1	8 13	11 12	8 15	11 8	8 10	10 11	7 14	11 12	9 5	142 4	20 5
4	Cross short-horn	7	Feb. 15	1,090	11 14	9 7	14 0	9 2	13 14	9 3	13 13	9 7	13 10	8 11	13 0	6 6	13 8	8 0	153 14	22 0
5	Ayrshire - -	8	Feb. 22	1,085	11 0	7 0	10 11	7 12	10 13	7 5	11 6	8 4	11 8	7 10	10 12	6 10	11 4	7 3	129 2	18 7
6	Cross short horn	6	April 14	1,096	17 14	10 12	18 4	13 8	18 12	13 9	20 0	11 0	20 10	11 8	19 0	13 0	20 0	11 15	216 0	30 14
7	Mongrel	Aged	April 12	802	11 12	6 15	11 6	6 6	11 0	6 7	11 2	6 4	10 9	6 6	10 0	6 6	11 10	7 0	124 5	17 10
8	Cross short-horn	5	April 16	1,190	10 10	8 1	10 4	8 7	9 4	8 3	9 5	7 14	9 0	8 5	10 6	8 2	11 2	8 7	127 6	18 3
9	Cross short-horn	7	April 15	1,097	15 6	10 8	17 1	10 7	16 2	10 5	15 11	11 10	14 11	11 13	15 7	9 14	14 6	11 8	184 10	26 6
10	Half short horn	5	April 25	1,273	21 11	11 15	20 5	14 6	20 2	13 2	21 2	13 9	20 10	13 13	19 11	11 15	21 4	10 13	234 6	33 5
			Totals	11,444	144 0	94 8	146 10	99 5	144 10	97 0	147 5	99 5	145 1	99 6	139 6	92 8	147 4	96 2	1,609 4	—
			Means	1,144	14 6	9 7	14 11	9 15	14 7	9 11	14 12	9 15	14 8	9 15	13 15	9 4	14 12	9 10	160 4	24 5
FIVE COWS.—UNSEWAGED OR SEWAGED ITALIAN RYE GRASS.																				
Food consumed. Grass	From which Field, Plot, and Crop				Rye, Plot 0*, Crop 4.		Rye, Plot 2, Crop 5.		Rye, Plot 2, Crop 5.		Rye, ‡ Crop 4, &c		Rye, ‡ Crop 4.		Rye, ‡ Crop 4.		Rye, ‡ Crop 4.		—	—
	Quantities weighed (tons. cwts. qrs. lbs.)				0 4 2 19½		0 4 3 9		0 4 2 5		0 4 0 6		0 3 2 10		0 3 3 21		0 3 3 21		1 8 3 7½	0 0 3 6
Oilcake	(3 parts cotton & 2 parts rape-cake) (ditto)				0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 1 2 7	0 0 0 5
1	Cross short-horn	Aged	April 20	1,121	20 8	13 0	20 0	12 4	19 14	13 1	18 10	12 6	20 6	12 13	16 7	14 9	18 0	11 4	224 3	32 0
2	Ayrshire - -	6	Mar. 15	954	17 7	11 0	17 15	10 13	17 10	11 8	17 14	11 9	18 0	10 11	18 2	11 0	18 4	10 5	202 2	28 14
3	Cross short horn	Aged	Mar. 1	1,366	14 0	8 12	15 8	9 11	14 1	8 14	14 15	8 4	15 3	10 8	14 2	10 0	15 5	8 5	169 14	24 4
4	Cross short horn	Aged	April 15	[illegible]	18 8	12 4	18 10	12 8	17 4	12 4	16 2	11 15	17 10	9 13	17 11	11 4	16 8	9 4	205 15	29 8

Five Cows.—Unsewaged Mea[redacted] Grass.

Food consumed. Grass: From which Field, Plot, and Crop					Five acre, Plot 1, Crop 1.		Ten acre, Plot 0*, Crop 1.		Ten acre, Plot 0*, Crop 1.		Ten-acre, Plot 0*, Crop 1.		Ten acre, Plot 0*, Crop 1.		Ten acre, Plot 0*, Crop 1.		Ten-acre, Plot 0*, Crop 1.		—	—
Grass: Quantities weighed (tons, cwts, qrs, lbs.)					0 2 3 8½		0 3 2 1		0 2 3 7½		0 4 0 27		0 1 3 0½		0 2 3 20½		0 2 3 24		1 0 3 9	0 0 3 11
Oilcake (cotton cake) (ditto)					0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
Yield of Milk, &c. Cows, Nos.	Breed.	Years old.	Dates of Calving.	Weights (July 20) lbs.	A.M.	[redacted]	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross short-horn	Aged	May 1	1,114	17 4	12 12	16 5	10 0	19 1	11 14	15 0	10 12	19 12	11 2	19 4	12 0	21 10	12 3	229 15	31 9
2	Cross short-horn	6	Feb. 15	1,230	12 12	8 10	14 4	9 1	13 7	8 4	13 14	8 8	14 4	8 4	14 0	8 9	14 11	8 9	138 11	22 6
3	Cross short horn	5	April 13	830	12 12	8 6	18 10	9 7	12 12	8 9	14 0	8 9	13 13	8 4	14 12	8 8	15 6	7 13	136 10	22 6
4	Cross short-horn	8	May 20	1,082	21 4	14 3	24 10	16 1	22 12	15 10	21 2	14 15	24 10	14 2	22 12	16 2	25 6	14 14	274 7	39 3
5	Cross short-horn	7	April 17	1,142	17 9	12 4	19 14	10 15	17 11	10 6	17 10	10 15	17 14	11 1	18 8	9 12	10 8	11 2	213 1	28 8
			Totals	5,404	81 0	57 3	90 11	63 8	85 11	54 11	88 10	53 11	90 4	57 13	89 4	51 15	86 0	54 5	1,013 12	—
			Means	1,081	16 5	11 7	18 2	12 11	17 2	10 15	17 11	10 12	18 1	11 9	17 14	11 0	18 5	10 14	202 12	28 15

Ten Cows.—Sewaged Meadow Grass.

Food consumed. Grass: From which Field, Plot, and Crop					Five acre, Plot 2, Crop 2		Ten acre, Plot 0*, Crop 2		Ten-acre, Plot 2, Crop 2.		Ten acre, Plot 2, Crop 2		Ten-acre, Plot 2, Crop 2.		Ten acre, Plot 2, Crop 2		Ten acre, Plot 2, Crop 2.		—	—
Grass: Quantities weighed (tons, cwts, qrs, lbs.)					1 4 0 17		0 11 0 9		0 6 2 11		0 14 2 7		0 13 1 20		0 14 0 17		0 14 0 22		4 18 0 23	0 1 1 17
Oilcake (cotton cake) (ditto)					0 0 1 2		0 0 1 3		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 1 3 14	0 0 0 5
Yield of Milk, &c. 1	Cross short-horn	Aged	Mar. 10	1,151	14 11	15 6	18 2	15 1	16 7	12 8	16 12	13 2	16 14	12 4	17 6	18 13	18 0	13 4	211 11	30 4
2	Cross short horn	8	June 15	1,394	21 6	16 0	23 11	10 2	22 8	15 0	22 0	14 11	22 2	14 5	23 2	13 6	24 6	13 13	263 12	37 11
3	Cross short horn	6	Feb. 20	1,146	18 10	12 8	18 14	11 3	13 13	11 4	13 6	11 0	13 8	11 2	14 2	10 4	14 0	10 11	174 8	24 14
4	Cross short horn	7	Feb. 15	1,040	13 6	10 4	18 8	10 12	14 10	10 2	14 11	9 2	16 6	9 0	13 10	9 14	15 8	8 6	173 8	24 12
5	Ayrshire	8	Feb. 22	1,029	18 0	10 8	15 7	11 0	14 6	9 11	14 13	10 4	14 4	9 6	13 7	9 0	15 12	9 4	173 8	24 12
6	Cross short-horn	6	April 14	1,016	17 7	12 9	20 13	12 15	18 12	11 12	19 2	11 10	20 2	11 7	20 6	11 10	21 2	12 0	221 6	31 10
7	Mongrel	Aged	April 12	892	13 2	11 11	17 6	10 11	14 6	9 10	15 1	9 6	14 10	9 10	15 6	9 6	16 10	8 13	175 14	25 2
8	Cross short-horn	6	April 16	1,122	10 8	11 0	11 15	10 13	11 12	10 1	11 10	9 0	13 0	10 2	19 8	10 8	12 4	8 6	153 7	21 13
9	Cross short horn	7	April 13	1,046	15 6	13 8	18 1	14 12	17 5	12 8	16 8	12 14	20 0	12 6	18 6	13 7	20 6	14 0	219 13	31 8
10	Half short horn	8	April 25	1,236	20 5	15 10	21 4	13 3	23 4	15 7	23 10	13 2	23 0	16 10	24 2	13 8	23 8	14 10	200 12	34 2
			Totals	11,065	152 3	127 0	177 1	120 8	167 7	117 15	167 11	110 3	173 9	140 4	170 7	118 5	163 8	113 11	2,053 11	—
			Means	1,106	15 3	12 11	17 11	12 11	16 12	11 13	16 12	11 10	17 6	11 10	17 10	11 13	18 6	11 0	205 6	29 1

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Food consumed. Grass: From which Field, Plot, and Crop					Rye, Plot 2, Crop 3.		Rye, Plot 2, Crop 3.		Rye, Plot 2, Crop 3		Rye, Plot 2, Crop 3.		Rye, Plot 2, Crop 3.		Rye, Plot 2, Crop 3.		Rye, Plot 2, Crop 3.		—	—
Grass: Quantities weighed (tons, cwts, qrs, lbs.)					0 6 3 8		0 7 0 9		0 10 1 23		0 5 2 24		0 7 0 11		0 6 3 7		0 0 3 8		2 10 3 1	0 1 1 22
Oilcake (cotton cake) (ditto)					0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 13		0 0 0 15		0 [illegible] 3 21	0 0 0 3
Yield of Milk, &c. 1	Cross short-horn	Aged	April 20	1,140	20 1	15 13	25 2	14 14	22 8	13 10	22 8	12 5	23 12	13 14	22 8	14 10	23 10	16 0	258 3	36 14
2	Ayrshire	6	Mar. 15	910	16 5	11 0	16 8	11 2	16 4	11 0	15 10	10 7	17 0	10 11	17 12	10 12	19 0	10 7	194 2	27 12
3	Cross short horn	Aged	Mar. 1	1,130	14 0	9 6	16 1	9 5	14 8	9 0	13 11	8 11	16 0	9 3	15 2	9 10	15 5	8 12	169 5	24 1
4	Cross short horn	Aged	April 15	1,218	16 3	12 15	19 0	13 14	18 1	12 12	21 0	10 6	19 0	11 9	20 2	12 8	15 12	12 10	225 10	31 15
5	Cross short horn	4	Jan. 2	1,184	11 10	7 13	13 15	8 4	12 11	7 8	12 8	8 7	13 4	7 13	13 6	8 2	12 8	9 12	147 6	21 1
			Totals	5,582	78 3	54 12	90 10	57 7	84 0	54 4	85 5	50 4	90 1	53 9	88 14	55 10	93 14	57 2	991 13	—

Record of Food consumed, and Milk yielded, by Cows fed on Unsewaged and Sewaged Meadow Grass, and on Italian Rye Grass with Oilcake in addition.
Third Season, 1863; 7 days.—July 28 to August 3.

					Tuesday.		Wednesday		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Five Cows.—Unsewaged Meadow Grass. a																				
Food consumed. Grass — From which Field, Plot, and Crop					Five-acre, Plot 1, Crop 1.		—		Five-acre, Plot 0*, Crop 1.		Ten-acre, Plot 0*, Crop 1.		Ten-acre, Plot 0*, Crop 1.		Rye, Plot 1, Crop 3.		Rye, Plot 1, Crop 3.		—	—
Grass — Quantities weighed (*tons cwts. qrs. lbs.*)					0 3 3 13½		—		0 1 2 13		0 2 3 1½		0 3 1 6½		0 2 2 10½		0 2 3 21		0 16 3 19	0 0 1 26
Oilcake (cotton-cake) — (*ditto*)					0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
Yield of Milk, &c. Cows Nos.	Breed.	Years old.	Dates of Calving.	Weights (July 20) lbs	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross short-horn	Aged	May 1	1,138†	20 6	13 2	20 10	12 9	20 4	11 13	20 11	13 1	21 10	13 1	20 12	18 3	21 5	14 0	236 13	33 13
2	Cross short-horn	6	Feb 15	1,234†	13 10	9 2	14 2	8 6	13 11	8 8	13 10	8 2	15 8	8 9	14 10	8 8	15 8	8 11	156 4	22 5
3	Cross short-horn	3	April 13	854†	15 8	9 11	16 2	9 4	14 14	8 4	15 0	9 10	14 10	10 7	16 1	9 10	14 5	7 6	170 14	24 7
4	Cross short-horn	8	May 20	1,318†	24 4	15 0	23 4	15 8	23 7	15 0	24 8	14 14	25 0	16 2	23 4	16 1	23 8	18 12	274 14	39 9
5	Cross short-horn	7	April 17	1,170†	19 0	11 2	18 13	10 13	17 6	10 10	17 6	11 5	17 2	9 10	17 8	11 3	17 3	10 2	189 8	26 7
			Totals	5,514	92 12	69 1	94 15	56 8	89 10	54 4	91 3	57 0	91 14	57 13	90 3	58 0	91 13	54 7	1,040 0	—
			Means	1,103	18 9	11 13	19 0	11 5	17 15	10 13	18 4	11 6	18 6	11 9	18 1	11 11	18 6	10 14	208 0	29 11
Ten Cows.—Sewaged Meadow Grass.																				
Food consumed. Grass — From which Field, Plot, and Crop					Five acre, Plot 2, Crop 2.		Ten-acre, Plot 2, Crop 2.		Ten-acre, Plot 2, Crop 2		Five-acre, Plot 0*, Crop 2.		Ten-acre, Plot 4, Crop 3.		Five-acre, Plot 4, Crop 3.		Five-acre, Plot 4, Crop 3.		—	—
Grass — Quantities weighed (*tons. cwts. qrs. lbs.*)					0 14 3 15		0 18 0 8		1 1 0 23		0 18 3 6½		0 9 3 12		0 15 2 4		0 15 2 9		5 11 3 21	0 1 2 11
Oilcake (cotton cake) — (*ditto*)					0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 1 3 14	0 0 0 3
1	Cross short horn	Aged	Mar. 10	1,164	17 0	14 6	17 11	14 0	17 12	12 10	16 6	18 10	18 0	13 12	18 8	12 13	18 8	11 10	216 11	30 15
2	Cross short horn	8	June 15	1,384	21 10	16 1	24 0	10 7	22 12	13 9	22 4	10 1	23 3	13 14	23 9	15 13	23 12	10 2	273 0	39 0
3	Cross short-horn	6	Feb. 20	1,140	13 6	12 3	14 12	10 5	14 5	10 13	13 14	11 0	15 13	12 1	14 0	0 8	13 11	10 9	174 5	24 14
4	Cross short-horn	7	Feb. 13	1,040	14 0	10 2	15 6	9 4	14 13	9 2	14 4	10 14	15 12	9 12	14 13	10 1	10 14	9 12	174 13	25 0
5	Ayrshire	8	Feb. 23	1,029	14 6	10 12	15 4	8 9	14 6	9 7	16 5	10 6	15 0	10 5	14 6	0 1	14 12	8 15	170 14	24 7
6	Cross short-horn	6	April 14	1,016	10 4	12 5	21 0	11 3	20 0	11 8	19 7	13 0	21 2	12 0	18 3	12 3	20 6	12 0	224 9	32 1
7	Mongrel	Aged	April 12	892	14 0	10 9	16 0	9 9	15 12	9 5	15 2	10 12	13 8	10 14	16 4	9 6	15 3	7 14	176 2	25 3
8	Cross short horn	6	April 16	1,122	11 10	11 3	11 7	10 8	12 4	10 1	13 4	10 4	14 12	9 14	14 12	0 15	12 10	10 10	162 15	23 4
9	Cross short horn	7	April 13	1,040	19 0	13 6	19 4	10 0	19 0	13 3	18 12	13 0	21 0	8 12	19 8	12 7	18 6	11 6	223 15	32 0
10	Half short-horn	8	April 23	1,286	22 0	17 14	24 3	14 9	23 10	15 2	21 8	16 11	23 4	15 12	23 12	15 11	23 0	13 2	272 2	38 14
			Totals	11,053	166 4	128 13	174 15	120 8	174 10	116 12	170 2	125 10	181 4	120 0	178 12	116 14	179 2	111 15	2,069 4	—
			Means	1,105	16 10	12 14	17 14	12 0	17 8	11 11	17 0	12 9	18 9	12 0	17 14	11 11	17 15	11 3	206 15	29 9
Five Cows.—Unsewaged or Sewaged Italian Rye Grass.																				
Food consumed. Grass — From which Field, Plot, and Crop					Rye, Plot 2, Crop 3.		Rye, Plot 3, Crop 4.		Rye, Plot 3, Crop 4		Rye, Plot 3, Crop 4.		Rye, Plot 3, Crop 4.		Rye, Plot 3, Crop 4.		Rye, Plot 3, Crop 4.		—	—
Grass — Quantities weighed (*tons. cwts. qrs. lbs.*)					0 7 0 1		0 8 3 16½		0 7 1 23		0 9 1 1		0 7 3 0		0 4 0 23		0 4 1 0		2 8 2 7	0 1 1 15
Oilcake (cotton-cake) — (*ditto*)					0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 13		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
1	Cross short horn	Aged	April 20	1,140	21 3	10 5	22 0	13 2	21 12	13 14	22 3	14 0	22 0	12 0	22 0	15 6	21 7	12 5	249 11	35 11
2	Ayrshire	6	Mar. 15	910	18 4	10 11	18 4	9 12	17 11	10 4	17 1	10 10	17 5	9 12	18 5	10 15	18 0	9 10	196 6	28 1
3	Cross short horn	Aged	Mar. 1	1,190	15 5	9 12	15 2	9 5	15 6	9 5	14 9	9 5	14 6	9 0	14 8	10 9	15 6	9 0	174 1	24 14
4	Cross short horn	Aged	April 15	1,275	16 10	13 7	19 5	10 0	19 1	11 13	20 15	12 12	20 12	13 10	21 9	15 1	19 9	13 14	223 13	31 15
5	Cross short horn	9	Jan 9	1,184	12 10	8 14	12 7	8 2	12 0	8 4	12 3	9 0	12 1	7 8	11 14	8 5	11 10	8 0	143 10	20 8

FIVE COWS.—UNSEWAGED MEADOW GRASS.

Food consumed.																				
Grass: From which Field, Plot, and Crop					Rye, Plot 1, Crop 3.		Rye, Plot 1, Crop 3.		Rye, Plot 1, Crop 3.		Rye, Plot 1, Crop 3.		Rye, Plot 1, Crop 3.		Rye, Plot 1, Crop 3.		Rye, Plot 1, Crop 3.		—	—
Grass: Quantities weighed (tons, cwts, qrs, lbs.)					0 5 3 17½		0 5 0 4½		0 1 1 2½		0 4 1 10		0 8 3 10½		0 3 2 4½		0 5 3 8		1 7 1 1½	0 0 3 8
Oilcake (cotton-cake) (ditto)					0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 16		0 0 0 15		0 0 0 16		0 0 0 15		0 0 3 21	0 0 0 3
Yield of Milk, &c. Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (July 30) lbs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	— lbs. ozs.	— lbs. ozs.
1	Cross short horn	Aged	May 1	1,139*	18 0	12 12	18 12	13 8	21 10	14 0	20 13	13 9	21 15	14 4	21 10	13 13	23 0	14 1	240 5	34 5
2	Cross short horn	6	Feb. 15	1,234*	14 8	9 0	18 11	8 0	14 4	9 0	14 0	8 0	13 10	8 10	15 8	7 3	12 6	8 9	163 6	21 15
3	Cross short horn	5	April 13	854*	16 1	10 8	15 0	9 15	16 11	9 10	16 2	9 12	15 10	10 13	15 10	8 11	16 5	9 2	179 1	25 9
4	Cross-short-horn	8	May 20	1,118*	28 1	10 4	24 15	16 4	28 12	15 12	26 4	14 8	23 11	15 8	28 13	14 0	25 0	15 14	267 11	41 9
5	Cross short horn	7	April 17	1,170*	17 11	12 8	16 14	10 8	18 12	11 0	16 10	11 0	17 0	12 7	17 8	10 12	19 1	10 11	206 12	29 8
			Totals	5,514	92 0	61 0	91 10	58 7	98 1	59 12	95 13	56 8	90 14	61 10	96 1	53 7	94 12	54 4	1,067 3	—
			Means	1,103	18 6	12 3	18 5	11 11	19 10	11 15	19 [illegible]	11 5	[illegible] 8	12 5	19 0	10 11	18 15	11 13	213 7	30 8

TEN COWS.—SEWAGED MEADOW GRASS.

Food consumed.																				
Grass: From which Field, Plot, and Crop					Five-acre, Plot 4, Crop 3.		Five-acre, Plot 4, Crop 3.		Five acre, Plot 4, Crop 3.		Five acre, Plot 4, Crop 3.		Ten acre, Plot 4, Crop 3.		Five acre, Plot 3, Crop 3.		Five-acre, Plot 3, Crop 3		—	—
Grass: Quantities weighed (tons, cwts, qrs, lbs.)					0 18 0 3		0 15 0 2		0 18 1 16		0 19 0 14		0 15 1 23		0 15 0 14		0 15 0 16		5 17 1 4	0 1 3 20
Oilcake (cotton cake) (ditto)					0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 1 3 14	0 0 0 8
Yield of Milk, &c.																				
1	Cross short horn	Aged	Mar. 10	1,154	17 10	18 12	17 14	13 9	18 3	12 10	17 12	12 9	17 0	13 14	17 8	11 4	17 8	12 13	212 12	30 6
2	Cross short horn	8	June 15	1,284	22 11	15 8	22 3	16 0	21 12	13 11	21 0	15 10	22 4	15 3	21 8	13 0	21 12	14 3	256 5	36 14
3	Cross short horn	6	Feb. 20	1,146	13 10	10 0	13 4	11 1	12 14	11 0	13 8	10 0	13 12	10 1	13 10	9 2	14 7	9 14	165 9	25 13
4	Cross short horn	7	Feb. 15	1,040	15 11	10 0	16 0	11 5	16 8	11 11	13 12	11 6	16 1	9 13	15 0	9 8	15 0	9 10	163 11	26 4
5	Ayrshire	8	Feb. 22	1,080	14 0	8 15	14 1	9 2	14 6	9 12	14 14	0 8	14 4	8 6	14 0	7 14	14 10	8 9	162 5	25 8
6	Cross short horn	6	April 14	1,016	20 1	11 7	19 2	11 3	20 4	12 0	19 14	11 10	19 2	11 4	19 10	10 0	20 2	11 14	217 9	31 1
7	Mongrel	Aged	April 12	892	14 6	8 14	14 12	9 11	13 12	8 10	15 7	8 14	15 10	9 0	15 0	8 7	16 0	8 9	160 0	24 2
8	Cross short-horn	6	April 16	1,122	12 0	9 3	12 2	9 6	11 0	10 8	11 0	8 14	11 10	9 10	12 9	9 0	12 0	11 8	151 6	21 10
9	Cross short horn	7	April 13	1,046	17 4	14 2	17 9	12 12	13 4	10 6	15 6	13 0	13 0	15 14	17 2	10 3	18 14	11 0	203 12	29 2
10	Half short horn	6	April 26	1,226	23 8	15 12	21 3	16 8	25 6	15 0	23 15	13 0	23 12	14 15	23 0	14 12	23 4	14 9	270 5	39 10
			Totals	11,055	169 13	110 15	168 2	120 4	171 5	117 4	169 1	117 7	168 7	118 0	170 0	103 2	173 15	112 6	1,963 7	–
			Means	1,106	17 0	11 11	16 13	12 0	17 2	11 12	16 14	11 12	16 13	11 13	17 1	10 5	17 5	11 4	109 9	29 8

FIVE COWS.—S[illegible]GED OR UN[illegible]WAGED ITALIAN RYE GR[illegible]

Food consumed.																				
Grass: From which Field, Plot, and Crop					Rye, Plot 3, Crop 4.		Rye, Plot 3, Crop 4.		Rye, Plot 3, Crop 4.		Rye, Plot 3, Crop 4		Rye, Plot 3, Crop 4.		Rye, Plot 3, Crop 4.		Rye, Plot 3, Crop 4		—	—
Grass: Quantities weighed (tons, cwts, qrs, lbs.)					0 4 3 23		0 8 3 25		0 5 3 17		0 6 2 22		0 5 2 23		0 4 3 21		0 4 3 26		2 1 3 10	0 1 0 23
Oilcake (cotton-cake) (ditto)					0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
Yield of Milk, &c.																				
1	Cross short horn	Aged	April 20	1,140	21 8	18 6	22 10	14 8	21 10	13 4	23 2	12 10	24 0	12 6	13 11	13 4	23 10	18 10	245 5	35 1
2	Ayrshire	6	Mar. 15	910	16 11	11 9	18 3	10 14	18 3	10 11	17 6	9 6	16 8	9 8	28 13	10 3	20 0	11 10	204 9	29 4
3	Cross short horn	Aged	Mar. 1	1,130	15 12	10 7	16 0	10 0	16 1	9 1	14 1	8 10	14 0	9 3	13 11	10 12	17 1	9 6	174 1	24 14
4	Cross short horn	Aged	April 15	1,278	21 2	14 12	21 3	13 13	21 13	12 4	2[illegible] 4	13 0	20 14	11 10	21 8	11 13	24 5	12 14	244 5	34 14
5	Cross short horn	6	Jan. 2	1,184	12 7	6 0	9 0	7 4	11 8	7 14	12 14	7 2	11 13	8 10	11 10	9 10	13 4	7 13	135 10	19 6
			Totals	5,682	87 8	58 2	87 0	58 7	89 1	53 2	88 11	50 12	87 2	58 7	84 5	54 12	98 4	55 5	1,008 14	—

Table X.—*continued.*

Detailed [redacted] of Food consumed, and Milk yielded, by Cows fed on Unsewaged and Sewaged Meadow Grass, and on Italian Rye Grass, with Oilcake in addition.

Third Season, 1863; 7 days.—August 11 to August 17.

						Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
FIVE COWS.—UNSEWAGED MEADOW GRASS. a																					
Food consumed.	Grass: From which Field, Plot, and Crop					Rye, Plot 1, Crop 3.		Rye, Plot 1, Crop 3.		Rye, Crop 3*.		Rye, Crop 3*.		Rye, Crop 3*.		Rye, Crop 3*.		Rye, Crop 3*.		—	—
	Grass: Quantities weighed (tons, cwts, qrs, lbs.)					0 3 2 9½		0 2 1 17½		0 2 0 21		0 3 1 10		0 3 3 4		0 3 1 16		0 2 1 17		0 19 3 13	0 0 2 8
	Oilcake (cotton cake) (ditto)					0 0 0 13		0 0 0 13		0 0 0 13		0 0 0 13		0 0 0 13		0 0 0 13		0 0 0 13		0 0 3 21	0 0 0 3
Yield of Milk, &c.	Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (Aug. 17) lbs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	lbs. ozs.	lbs. ozs.
	1	Cross short horn	Aged	May 1	1,176	20 3	14 7	20 10	14 3	22 0	13 0	21 12	15 3	21 14	13 4	20 10	13 8	22 0	13 6	243 15	35 3
	2	Cross short horn	6	Feb. 15	1,253	13 0	8 9	12 13	7 11	14 0	8 0	13 8	7 14	12 12	8 6	13 0	7 0	13 2	7 7	148 14	21 4
	3	Cross short horn	5	April 13	978	15 8	9 10	16 0	9 8	15 14	10 4	16 1	9 15	16 0	9 8	16 2	9 1	16 8	8 12	176 11	25 3
	4	Cross short horn	8	May 20	1,118	25 10	16 6	24 2	15 12	25 15	15 7	25 8	16 4	25 8	14 3	25 1	14 0	27 10	14 4	285 10	40 13
	5	Cross short-horn	7	April 17	1,104	17 7	11 0	18 2	12 0	18 1	11 6	17 13	11 13	17 6	11 0	17 2	11 4	19 4	12 6	208 0	29 7
				Totals	5,610	91 12	59 9	91 11	59 4	93 14	55 1	94 10	61 1	93 6	56 5	91 15	54 13	100 6	56 3	1,065 2	—
				Means	1,124	18 6	11 15	18 5	11 13	19 3	11 10	18 15	12 3	18 11	11 4	18 6	10 15	20 2	11 4	213 0	[redacted] 7
TEN COWS.—SEWAGED MEADOW GRASS.																					
Food consumed.	Grass: From which Field, Plot, and Crop					Five acre, Plot 5, Crop 3.		Ten acre, Plot 4, Crop 3.		Ten acre, Plot 4, Crop 3.		Five acre, Plot 4, Crop 3.		Five-acre, Plot 4, Crop 3		Five-acre, Plot 5, Crop 3.		Five-acre, Plot 5, Crop 3.		—	—
	Grass: Quantities weighed (tons, cwts, qrs, lbs.)					1 1 3 13		0 14 3 1		0 13 3 14		0 16 1 20		0 19 3 11		0 12 0 4		0 12 0 5		5 9 3 15	0 1 2 6
	Oilcake (cotton cake) (ditto)					0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 1 3 14	0 0 0 5
Yield of Milk, &c.	1	Cross short horn	Aged	Mar. 10	1,182	17 0	13 9	17 0	11 4	16 11	11 10	17 10	12 15	16 12	11 6	16 0	11 0	18 2	11 12	202 4	28 14
	2	Cross short horn	6	June 15	1,394	21 2	13 9	20 7	13 5	21 4	14 4	22 1	14 14	21 2	13 8	20 8	12 0	22 6	13 2	214 14	25 0
	3	Cross short horn	6	Feb. 21	1,182	12 14	10 0	13 4	9 10	15 0	9 13	13 15	10 2	13 0	10 3	13 12	9 1	13 12	9 12	160 13	23 0
	4	Cross short-horn	7	Feb. 15	1,070	14 12	10 0	14 0	0 2	14 10	9 10	13 8	10 6	13 12	9 7	14 1	6 6	13 10	9 0	165 13	23 11
	5	Ayrshire –	8	Feb. 23	1,149	13 6	8 11	13 1	6 10	12 0	8 2	11 6	7 14	11 6	8 5	11 2	7 0	12 0	8 0	138 15	19 14
	6	Cross short horn	6	April 14	1,048	19 4	11 3	19 0	10 10	19 1	10 11	19 12	13 3	19 7	11 3	18 8	10 2	20 6	10 14	212 4	30 5
	7	Mongrel – –	Aged	April 12	984	15 0	8 5	15 2	8 4	14 2	9 0	14 0	9 4	15 8	8 2	14 10	8 3	17 1	9 0	165 15	23 11
	8	Cross short horn	6	April 16	1,110	11 10	9 1	11 12	9 6	11 0	9 4	10 8	10 8	12 11	10 0	12 0	9 4	12 8	10 6	140 14	21 7
	9	Cross short horn	7	April 13	1,040	14 1	12 3	16 8	12 10	18 2	11 12	17 10	14 11	18 14	11 13	19 10	10 7	19 0	12 0	210 11	30 1
	10	Half short horn	8	April 23	1,320	24 4	14 3	23 0	14 4	22 6	15 4	23 2	13 7	23 0	13 6	22 2	13 4	23 10	15 4	264 8	37 6
				Totals	11,299	165 4	110 5	162 13	105 1	161 4	108 5	161 6	116 0	165 8	107 7	163 4	100 1	174 7	110 10	1,913 1	—
				Means	1,131	16 5	11 1	16 4	10 8	16 2	10 13	16 2	11 13	16 9	10 12	16 4	10 0	17 7	11 1	191 5	27 5
FIVE COWS.—UNSEWAGED OR SEWAGED ITALIAN RYE GRASS.																					
Food consumed.	Grass: From which Field, Plot, and Crop					Rye, Plots 2 & 3, Crop 4		Rye, Plot 2, Crop 4.		Rye, Plot 2, Crop 4, & Plot 01, Crop 3.		Rye, Plot 01, Crop 3.		Rye, Plot 01, Crop 3.		Rye, Plot 01, Crop 3.		Rye, Plot 01, Crop 3.		—	—
	Grass: Quantities weighed (tons, cwts, qrs, lbs.)					0 7 1 0		0 4 1 11		0 4 3 2½		0 4 1 25½		0 4 1 17½		0 2 3 9½		0 2 3 23		1 13 1 22	0 0 3 20
	Oilcake (cotton cake) (ditto)					0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
Yield	[redacted]	Cross short horn	Aged	April 20	1,120	23 12	14 12	23 11	14 6	24 0	13 2	23 10	14 1	22 4	12 8	20 0	13 7	23 8	11 4	236 14	33 11
		Ayrshire –	6	Mar. 15	972	19 14	11 6	18 8	13 7	17 10	11 8	17 13	12 0	17 4	10 15	18 14	11 12	18 0	9 9	205 7	29 5
		Cross short-horn	Aged	Mar. 1	1,146	15 8	9 13	16 10	9 7	16 1	9 7	11 4	4 10	15 6	7 7	15 15	9 3	13 14	8 4	167 10	23 15

Five Cows.—Unsewaged Meadow Grass.

Food consumed					Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	7 days.	[illegible] day.
Grass: From which Field, Plot, and Crop					• Rye, Crop 3.		• Rye, Crop 3.		• Rye, Crop 2.		• Rye, Crop 3.		• Rye, Crop 3.		• Rye, Crop 3.		• Rye, Crop 3.		—	—
Grass: Quantities weighed (*tons. cwts. qrs. lbs.*)					0 2 0 9		0 3 0 8		0 4 0 12		0 1 3 6		0 2 0 3		0 2 0 25		0 3 0 21		0 17 2 1	0 0 2 0
Oilcake (cotton-cake) (*ditto*)					0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
Yield of Milk, &c. Cows. Nos.	Breed.	Years old.	Dates of Calving	Weights (Aug. 17) *lbs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*
1	Cross short horn	Aged	May 1	1,370	21 6	13 4	22 1	14 2	21 14	14 0	22 0	13 13	22 7	12 12	21 11	13 4	22 0	12 0	247 1	35 5
2	Cross short-horn	6	Feb. 15	1,238	14 0	8 6	14 6	8 3	13 6	9 6	13 8	8 13	14 4	7 7	13 0	8 3	13 8	8 6	154 8	22 1
3	Cross short-horn	5	April 18	878	13 12	9 7	16 0	10 3	16 6	9 6	16 0	9 6	16 6	8 9	16 1	8 14	16 4	8 8	178 2	25 7
4	Cross short horn	8	May 20	1,116	24 6	16 5	25 8	15 7	26 0	16 5	25 0	15 13	24 14	17 10	26 0	15 7	27 0	15 4	289 5	41 3
5	Cross short-horn	7	April 17	1,194	18 0	11 1	16 6	11 0	18 2	11 0	18 0	10 6	18 1	10 6	18 0	9 14	18 2	9 12	200 13	28 11
			Totals	5,610	93 8	58 7	90 5	58 13	96 2	60 0	94 8	58 3	96 0	57 15	96 5	53 9	98 12	54 4	1,069 13	—
			Means	1,124	18 11	11 11	19 4	11 13	19 4	12 0	18 14	11 10	19 3	11 9	19 3	10 11	19 6	10 14	213 15	30 9

Ten Cows.—Sewaged Meadow Grass.

Food consumed					Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	7 days.	[illegible] day.
Grass: From which Field, Plot, and Crop					Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		Ten-acre, Plot 4, Crop 3.		—	—
Grass: Quantities weighed (*tons. cwts. qrs. lbs.*)					0 15 0 8		0 15 0 19		0 16 0 16		0 16 0 16		0 16 1 24		0 15 2 17		0 15 2 23		5 10 1 8	0 1 2 0
Oilcake (cotton-cake) (*ditto*)					0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 1 3 14	0 0 0 8
Yield of Milk, &c.																				
1	Cross short horn	Aged	Mar. 10	1,182	16 4	11 12	16 0	12 7	17 2	12 3	16 1	12 4	18 12	10 6	17 2	11 0	16 10	11 0	195 15	28 0
2	Cross short horn	8	June 15	1,284	21 2	13 1	20 8	13 4	20 8	13 7	20 4	13 6	20 0	12 7	18 4	13 14	21 0	13 4	234 5	33 7
3	Cross short horn	6	Feb. 20	1,183	13 5	10 2	12 9	9 10	13 10	9 4	12 14	9 14	12 11	9 12	12 14	9 0	12 11	9 8	157 2	22 7
4	Cross short horn	7	Feb. 15	1,479	14 12	9 14	13 10	9 4	14 2	9 2	14 0	10 1	14 14	9 6	12 0	9 7	17 6	8 14	164 12	23 8
5	Ayrshire	8	Feb. 22	1,019	11 8	8 11	12 11	8 7	12 5	9 0	12 6	8 1	13 1	8 3	13 2	8 0	13 0	9 0	147 5	21 1
6	Cross short horn	6	April 14	1,048	19 0	11 5	18 11	11 5	17 12	11 1	19 0	11 9	18 0	12 0	18 10	10 8	19 1	10 7	208 8	29 13
7	Monore.	Aged	April 12	864	16 1	9 1	15 15	8 11	14 14	10 4	15 4	8 14	15 4	8 14	14 14	8 7	15 4	7 0	168 8	24 1
8	Cross short horn	6	April 18	1,140	11 12	9 8	10 0	9 8	12 4	8 4	12 10	9 2	12 8	9 14	13 4	9 0	13 2	8 0	150 5	21 8
9	Cross short horn	7	April 19	1,040	20 3	11 10	16 1	13 12	18 0	12 8	17 4	12 10	16 14	13 5	14 6	14 0	15 14	13 8	211 10	30 4
10	Half short horn	8	April 23	1,200	21 4	16 4	20 11	15 1	21 2	14 12	21 12	14 12	21 8	13 4	20 12	12 10	21 15	13 0	247 11	35 6
			Totals	11,209	163 3	111 4	160 11	111 5	161 9	110 13	161 7	110 9	160 8	107 8	155 4	105 4	161 15	108 13	1,886 1	—
			Means	1,121	16 5	11 2	16 1	11 2	16 3	11 1	16 2	11 1	16 1	10 12	15 8	10 9	16 3	10 8	188 10	26 15

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Food consumed					Tuesday. A.M.	Tuesday. P.M.	Wednesday. A.M.	Wednesday. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Monday. A.M.	Monday. P.M.	7 days.	[illegible] day.
Grass: From which Field, Plot, and Crop					Rye, Plot 0†, Crop 3.		Rye, Plot 0†, Crop 3.		Rye, Plot 0†, Crop 3.		Rye, Plot 0†, Crop 3.		Rye, Plot 0†, Crop 3.		Rye, Plot 0†, Crop 3.		Rye, Plot 0†, Crop 3.		—	—
Grass: Quantities weighed (*tons. cwts. qrs. lbs.*)					0 4 2 17½		0 4 2 13½		0 5 1 21		0 4 2 7½		0 4 0 14¼		0 3 0 5½		0 3 0 8		1 9 2 5½	0 0 3 11
Oilcake (cotton-cake) (*ditto*)					0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
Yield of Milk, &c.																				
1	Cross short horn	Aged	April 20	1,150	21 12	13 7	22 11	12 11	21 12	13 5	21 2	13 4	20 12	15 5	21 8	12 6	23 7	10 12	244 3	34 14
2	Ayrshire	5	Mar. 15	922	17 10	11 10	17 7	10 8	18 4	10 15	17 2	11 8	18 0	10 1	18 5	10 11	17 12	9 6	190 3	28 7
3	Cross short-horn	Aged	Mar. 1	1,146	15 13	9 4	15 12	9 4	15 12	9 4	15 10	9 7	16 4	9 8	15 3	9 6	16 10	8 5	175 6	25 1
4	Cross short-horn	Aged	April 18	1,271	19 14	11 12	19 9	12 12	19 0	12 11	20 6	10 9	18 7	11 11	21 5	11 4	20 10	11 13	223 4	31 13
5	Cross short-horn	6	Jan. 9	1,195	14 0	8 1	12 13	8 9	13 12	6 13	13 6	6 2	12 0	6 11	12 4	6 2	13 10	6 6	151 10	21 11
			Totals	5,684	89 1	54 2	89 4	53 12	89 1	55 0	87 10	53 15	85 7	55 4	88 9	51 13	93 1	46 10	992 5	—

Table X.—continued.

Detailed Record of Food consumed, and Milk yielded, by Cows fed on Unsewaged and Sewaged Meadow Grass, and on Italian Rye Grass, with Oilcake in addition.

Third Season, 1883; 7 days.—August 25 to August 31.

FIVE COWS.—UNSEWAGED MEADOW GRASS. a

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed.	Grass { From which Field, Plot, and Crop				* Rye, Crop 3.		* Rye, Crop 3.		* Rye, Crop 3.		* Rye, Crop 3.		* Rye, Crop 3.		* Rye, Crop 3.		* Rye, Crop 3.		—	—
	Grass { Quantities weighed (tons. cwts. qrs. lbs.)				0 1 3 24		0 3 3 3		0 2 3 23		0 2 0 5		0 2 2 11		0 1 1 20		0 1 1 20		0 15 2 22	0 0 1 22
	Oilcake (cotton-cake) (ditto)				0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
Yield of Milk, &c.	Cows Nos.	Breed.	Years old.	Dates of Calving	Weights (Aug. 17) lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
						lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
	1	Cross short-horn	Aged	May 1	1,158	20 12	13 5	21 2	13 1	21 12	12 4	21 2	15 6	21 6	11 14	21 0	13 7	21 4	11 10	237 5	33 14
	2	Cross short horn	6	Feb. 15	1,253	19 11	7 0	19 7	7 6	19 11	8 6	11 0	7 14	11 10	6 4	10 8	7 11	11 0	7 14	134 8	19 3
	3	Cross short-horn	3	April 13	878	16 0	10 0	16 11	10 5	16 2	9 0	15 1	8 15	14 14	8 10	15 4	9 2	15 6	9 1	174 6	24 15
	4	Cross short horn	6	May 20	1,118	24 10	16 1	25 2	14 6	24 4	16 11	24 0	15 4	24 0	15 9	26 14	15 10	24 7	14 10	280 6	40 1
	5	Cross short-horn	7	April 17	1,194	17 12	10 0	17 11	10 12	16 5	10 8	16 2	9 2	16 13	8 12	17 0	9 0	16 11	9 13	188 7	26 15
				Totals	5,619	91 13	56 6	98 1	57 12	94 3	56 13	87 3	54 9	88 11	51 1	88 10	52 14	88 12	53 2	1,015 0	—
				Means	1,124	18 6	11 4	18 10	11 9	18 13	11 6	17 7	10 13	17 12	10 3	17 12	10 9	17 12	10 10	203 0	29 0

TEN COWS.—SEWAGED MEADOW GRASS.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed.	Grass { From which Field, Plot, and Crop				Ten acre, Plot 3, Crop 3.		Ten acre, Plot 3, Crop 3.		Ten acre, Plot 3, Crop 3.		Ten acre, Plot 3, Crop 3.		Ten-acre, Plot 3, Crop 3.		Ten acre, Plot 3, Crop 3.		Ten acre, Plot 3, Crop 3.		—	—
	Grass { Quantities weighed (tons. cwts. qrs. lbs.)				0 14 2 5		0 12 1 11		0 15 1 21		1 0 0 1		0 15 1 27		0 17 0 25		0 17 0 26		5 12 1 4	0 1 2 12
	Oilcake (cotton-cake) (ditto)				0 0 1 3		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 3		0 0 1 2		0 0 1 2		0 1 3 14	0 0 0 3
Yield of Milk, &c.	1	Cross short horn	Aged	Mar. 10	1,182	15 0	10 1	13 2	10 14	15 12	11 6	15 10	10 8	16 6	11 13	16 0	10 8	15 7	10 5	183 12	26 4
	2	Cross short-horn	6	June 15	1,384	10 10	11 8	16 1	12 11	20 0	12 12	18 4	12 10	16 7	11 12	10 6	11 8	10 2	12 6	215 1	30 12
	3	Cross short-horn	6	Feb. 20	1,182	12 14	9 6	12 5	9 9	12 6	9 0	12 6	9 10	13 4	9 10	12 13	9 0	12 1	9 0	153 4	21 14
	4	Cross short horn	7	Feb. 15	1,070	15 6	8 5	12 10	9 8	14 2	8 4	13 12	9 6	12 11	9 7	14 0	8 0	13 12	8 12	157 5	22 8
	5	Ayrshire	6	Feb. 22	1,019	12 2	7 15	12 6	8 1	12 14	9 3	12 5	8 12	14 8	8 10	13 0	10 0	12 6	8 11	150 11	21 8
	6	Cross short-horn	6	April 14	1,048	16 10	9 12	16 4	11 4	18 12	11 0	16 0	10 8	16 12	10 9	14 12	10 0	18 5	10 0	199 2	28 7
	7	Mongrel	Aged	April 19	884	12 7	7 12	14 8	7 9	14 9	7 15	13 8	8 0	12 9	8 2	11 3	7 8	12 6	8 0	144 6	20 10
	8	Cross short horn	6	April 10	1,140	12 0	8 10	11 0	9 6	11 6	9 8	11 0	8 14	10 11	7 12	14 2	7 14	13 4	7 11	143 3	20 5
	9	Cross short horn	7	April 15	1,040	18 2	12 9	15 6	11 4	17 10	9 4	17 0	10 12	16 6	11 2	17 3	8 14	16 8	10 10	190 8	27 3
	10	Half short-horn	8	April 25	1,360	19 6	12 4	19 7	13 10	20 4	14 8	18 10	13 6	20 4	12 12	20 0	12 11	20 5	13 4	230 10	32 15
				Totals	11,309	146 5	98 0	146 12	103 13	150 11	103 12	150 8	109 6	152 14	101 9	150 13	95 5	159 4	98 11	1,760 13	—
				Means	1,131	14 10	9 13	14 11	10 6	15 11	10 6	15 1	10 4	15 5	10 2	15 11	9 10	15 5	9 14	176 11	25 4

FIVE COWS.—UNSEWAGED OR SEWAGED ITALIAN RYE GRASS.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed.	Grass { From which Field, Plot, and Crop				Rye, Plot 2, Crop 4.		Rye, Plot 2, Crop 4.		Rye, Plot 2, Crop 4.		Rye, Plot 2, Crop 4.		Rye, Plot 2, Crop 4.		* Rye, Crop 3.		* Rye, Crop 3.		—	—
	Grass { Quantities weighed (tons. qrs. cwts. lbs.)				0 2 2 20		0 3 2 15		0 4 2 23		0 6 3 16		0 3 3 15		0 3 0 24		0 3 0 24		1 6 0 24	0 0 3 6
	Oilcake (cotton-cake) (ditto)				0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
	1	Cross short-horn	Aged	April 20	1,150	20 7	12 4	22 3	12 8	23 4	12 9	23 2	12 0	22 0	13 8	20 15	11 4	21 0	11 13	270 3	34 5
	2	Ayrshire	6	Mar. 15	992	18 8	10 1	17 6	10 10	17 4	11 7	18 0	11 6	17 5	11 6	17 6	9 1	16 7	10 12	197 1	28 2
	3	Cross short-horn	Aged	Mar. 1	1,146	15 0	8 11	11 6	10 0	16 8	9 9	14 5	9 12	15 6	9 12	15 8	9 2	14 7	9 3	174 1	24 14

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		7 days.	per day.

Five Cows.—Unsewaged Meadow Grass.a

Food consumed.					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		7 days.	per day.
Grass	From which Field, Plot, and Crop				Rye, Crop 3a.		Rye, Crop 3a.		Rye, Crop 3a.		Rye, Crop 3a.		Rye, Crop 3a.		Rye, Crop 3a.		Rye, Crop 3a.		—	—
Grass	Quantities weighed (tons, cwts, qrs, lbs.)				0 4 3 0		0 2 0 13		0 2 2 22		0 3 3 13		0 2 2 19		0 3 3 5		0 3 5 6		1 2 3 21	0 0 2 17
Oilcake (cotton-cake)	(ditto)				0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
Yield of Milk, &c. Cows, Nos.	Breed.	Years old.	Dates of Calving	Weights (Aug. 17) lbs.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	lbs. oz.	lbs. oz.
1	Cross short-horn	Aged	May 1	1,176	20 4	13 13	21 6	11 4	20 8	13 4	19 6	13 6	20 12	13 6	21 4	12 14	21 2	11 6	209 15	29 4
2	Cross short horn	6	Feb 15	1,253	12 2	6 11	12 0	5 11	10 0	7 8	10 0	6 6	12 12	7 3	11 0	6 12	12 2	7 2	127 7	18 3
3	Cross short horn	3	April 13	878	14 2	9 1	14 14	8 8	14 0	8 15	16 12	9 10	15 4	8 3	15 0	8 8	14 8	8 2	165 6	23 10
4	Cross short-horn	8	May 30	1,118	23 13	14 10	25 2	10 10	22 3	12 12	21 4	16 7	21 12	14 4	22 4	14 10	22 0	14 4	252 15	36 2
7	Cross short-horn	7	April 17	1,194	18 12	10 5	18 4	9 9	16 1	9 6	17 0	11 1	16 15	12 8	16 12	10 1	17 15	8 6	186 8	26 15
			Totals	5,619	88 1	54 8	87 10	45 1	82 12	50 13	83 6	58 14	87 7	56 10	86 4	52 13	87 12	49 4	967 3	—
			Means	1,124	17 3	10 14	17 8	9 0	16 9	10 3	16 11	11 6	17 8	11 5	17 4	10 9	17 9	9 14	193 7	27 10

Ten Cows.—Sewaged Meadow Grass.

Food consumed.					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		7 days.	per day.
Grass	From which Field, Plot, and Crop				Five-acre, Plot 4, Crop 4.		Five-acre, Plot 4, Crop 4.		Ten acre, Plot 4, Crop 4.		Five-acre, Plot 3, Crop 3.		Five acre, Plot 3, Crop 3.		Ten-acre, Plot 3, Crop 3.		Ten acre, Plot 3, Crop 3.		—	—
Grass	Quantities weighed (tons, cwts, qrs, lbs.)				0 17 0 10		0 18 1 14		0 12 1 20		0 13 3 0		1 6 0 17		0 12 1 2		0 12 1 8		5 19 1 24	0 1 3 12
Oilcake (cotton cake)	(ditto)				0 0 1 3		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 1 3 14	0 0 0 8
Yield of Milk, &c. 1	Cross short-horn	Aged	Mar. 10	1,183	15 9	10 0	14 12	10 7	15 0	10 4	15 1	11 14	14 14	11 2	13 6	9 10	14 0	9 10	177 11	25 6
2	Cross short-horn	6	June 15	1,264	18 2	12 6	16 13	12 10	18 4	12 2	19 8	13 9	10 12	12 12	18 14	11 7	19 2	11 14	216 14	31 0
3	Cross short-horn	6	Feb. 20	1,162	12 7	8 6	12 6	8 6	12 3	9 12	12 12	10 3	13 2	9 9	12 7	8 0	12 10	8 7	150 12	21 9
4	Cross short horn	7	Feb. 15	1,070	13 8	9 0	12 1	7 14	12 0	8 8	13 0	9 0	13 12	8 8	12 4	7 4	12 4	8 3	147 2	21 0
5	Ayrshire	8	Feb. 22	1,019	13 0	8 6	12 0	8 1	11 12	7 8	11 12	8 8	12 7	8 10	12 3	7 6	12 0	7 4	140 6	20 1
6	Cross short-horn	6	April 14	1,048	18 4	10 15	16 7	10 14	18 12	10 15	19 1	10 15	19 8	11 6	18 0	10 2	18 12	11 0	206 13	29 9
7	Mongrel	Aged	April 12	884	13 6	7 5	11 15	6 6	12 8	7 8	13 10	7 13	12 8	7 10	13 0	7 1	11 12	7 0	237 5	19 10
8	Cross short-horn	6	April 16	1,140	11 0	9 10	10 14	7 12	10 0	7 11	9 0	8 5	10 6	8 9	10 8	7 5	11 0	7 6	129 6	18 6
9	Cross short-horn	7	April 18	1,040	14 1	11 8	15 0	11 0	14 1	10 8	14 14	9 4	15 0	11 10	14 6	10 4	15 12	9 12	176 11	25 4
10	Half short-horn	8	April 23	1,380	21 6	13 0	20 1	12 0	20 14	14 8	20 14	13 11	20 7	13 10	20 2	12 0	21 14	11 10	236 15	33 14
			Totals	11,209	149 11	100 8	144 7	96 8	145 0	98 0	148 8	102 11	151 12	105 6	147 8	90 1	149 2	92 2	1,719 15	—
			Means	1,121	15 0	10 1	14 7	9 10	14 8	9 14	14 14	10 4	[illegible] 3	10 5	14 12	9 0	14 15	9 3	172 0	24 9

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Food consumed.					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		7 days.	per day.
Grass	From which Field, Plot, and Crop				Rye, Plot 3, Crop 5.		Rye, Plot 3, Crop 5.		Rye, Plot 3, Crop 5.		Rye, Plot 3, Crop 5.		Rye, Plot 3, Crop 5.		Rye, Plot 3, Crop 5.		Rye, Plot 3, Crop 5.		—	—
Grass	Quantities weighed (tons, cwts, qrs, lbs.)				0 6 1 10		0 4 0 11		0 4 2 23		0 5 0 15		0 5 3 5		0 4 3 11		0 4 2 17		1 17 1 8	0 1 0 7
Oilcake (cotton cake)	(ditto)				0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
Yield of Milk, &c. 1	Cross short-horn	Aged	April 30	1,150	21 1	11 13	21 0	11 2	20 14	13 9	21 0	13 8	20 12	8 2	20 4	11 10	20 12	10 9	236 6	33 5
2	Ayrshire	6	Mar. 25	932	15 8	11 5	17 8	7 14	14 6	10 4	18 10	12 2	16 8	0 10	17 8	9 10	18 0	9 2	184 13	26 6
3	Cross short horn	Aged	Mar 1	1,146	18 6	8 0	15 12	9 0	16 11	0 4	14 6	9 14	14 10	8 12	18 10	9 15	17 10	8 6	177 10	25 6
4	Cross short-horn	Aged	April 15	1,371	20 11	11 14	20 7	12 1	19 0	13 14	19 10	13 14	20 1	11 5	20 6	12 1	21 5	10 4	225 13	32 4
5	Cross short horn	6	Jan. 9	1,185	12 5	7 10	13 4	7 7	13 3	8 11	13 11	8 3	13 14	7 11	13 4	5 0	14 0	8 6	149 1	21 5
			Totals	5,684	87 15	51 1	88 5	48 1	84 5	50 10	87 0	57 9	84 13	46 8	87 0	51 13	93 11	46 11	983 11	

Detailed Record of Food consumed, and Milk yielded, by Cows fed on Unsewaged and Sewaged Meadow Grass, and on Italian Rye Grass, with Oilcake in addition.
Third Season, 1868; 7 days.—September 8 to September 14.

FIVE COWS.—UNSEWAGED MEADOW GRASS. a

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed. Grass — From which Field, Plot, and Crop					Rye,* Crop 3.		Five-acre, Plot 0†, Crop 2.		Five acre, Plot 0†, Crop 2.		Ten-acre, Plot 0†, Crop 2.		Ten acre, Plot 0†, Crop 2.		Five acre, Plot 0†, Crop 2.		Five-acre, Plot 0†, Crop 2.		—	—
Quantities weighed (tons. cwts. qrs. lbs.)					0 3 2 23		0 3 3 22½		0 5 1 10½		0 5 1 14		0 5 3 18½		0 4 3 22		0 4 3 27		1 14 1 3½	0 0 3 26
Oilcake (cotton-cake) (ditto.)					0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 13		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
Yield of Milk, &c. Cows. Nos.	Breed.	Years old.	Dates of Calving	Weights (Sept. 11) lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross short-horn	Aged	May 1	1,180½	21 4	13 3	20 8	12 6	21 0	13 2	20 15	11 8	21 4	12 10	20 11	11 5	21 10	13 4	233 12	33 6
2	Cross short-horn	6	Feb. 15	1,374½	10 14	8 1	11 10	7 10	11 8	7 11	12 0	7 0	11 12	7 6	11 6	7 12	11 0	7 13	135 9	19 6
3	Cross short-horn	5	April 13	809½	14 7	9 7	15 0	8 14	15 0	9 7	15 1	8 9	14 8	8 0	14 0	8 2	15 0	8 11	164 11	23 8
4	Cross short-horn	8	May 20	1,146½	20 1	13 8	22 10	14 11	22 10	15 10	22 7	14 14	22 4	14 14	22 4	14 10	23 2	15 0	261 0	37 6
5	Cross short-horn	7	April 17	1,267½	17 0	10 2	17 8	9 14	17 7	9 12	17 0	9 10	17 5	9 7	16 12	9 15	17 8	10 0	189 0	27 0
			Totals	5,772	83 10	50 5	87 4	53 0	88 2	55 10	87 7	51 9	87 15	52 5	85 1	51 10	90 4	55 14	984 9	—
			Means	1,154	16 12	10 1	17 7	10 12	17 10	11 2	17 8	10 5	17 9	10 7	17 0	10 5	18 1	11 3	196 15	28 2

TEN COWS.—SEWAGED MEADOW GRASS.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed. Grass — From which Field, Plot, and Crop					Five-acre, Plot 3, Crop 3.		Five-acre, Plot 4, Crop 4.		Five-acre, Plot 4, Crop 4.		Ten-acre, Plot 2, Crop 3.		Ten acre, Plot 2, Crop 3.		Five acre, Plot 2, Crop 3.		Five-acre, Plot 2, Crop 3.		—	—
Quantities weighed (tons. cwts. qrs. lbs.)					0 14 3 14		1 7 3 24		1 1 2 21		0 17 1 24		1 0 0 23		0 10 0 11		0 10 0 17		6 3 1 24	0 1 3 0
Oilcake (cotton-cake) (ditto.)					0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 0 1 2		0 1 3 14	0 0 0 3
1	Cross short-horn	Aged	Mar. 10	[illegible]	14 8	10 10	11 12	10 13	16 0	10 8	15 10	9 3	14 6	10 0	14 7	10 10	18 9	10 2	178 9	25 7
2	Cross short-horn	8	June 15	1,291	18 4	11 10	18 0	13 1	18 10	11 9	14 6	11 6	18 3	12 1	17 1	10 14	20 10	10 14	210 0	30 1
3	Cross short-horn	6	Feb. 20	1,174	12 4	8 11	12 1	9 3	12 13	9 6	13 0	7 8	11 10	8 4	11 12	7 14	12 12	7 0	141 5	20 10
4	Cross short-horn	7	Feb. 15	1,090	12 2	8 0	12 0	8 4	13 0	7 10	12 15	7 0	11 1	8 2	11 14	8 6	13 5	8 1	141 9	20 4
5	Ayrshire	8	Feb. 22	1,125	11 11	7 8	11 10	8 3	12 0	8 3	12 0	7 6	11 12	8 1	11 4	7 8	13 13	7 0	137 1	19 9
6	Cross short-horn	6	Apr. 14	1,031	18 5	11 4	17 11	11 12	18 12	11 0	17 4	9 8	17 7	11 2	17 6	10 4	17 10	10 13	200 2	28 9
7	Mongrel	Aged	Apr. 12	862	11 0	7 14	12 0	7 2	12 10	7 1	12 0	7 0	12 10	7 5	12 0	7 0	12 4	5 14	134 4	19 3
8	Cross short-horn	6	April 16	1,190	11 3	8 4	11 10	7 11	10 6	8 10	11 6	7 10	17 0	8 7	12 4	8 12	12 2	8 14	144 8	20 10
9	Cross short-horn	7	April 19	1,087	15 1	10 0	11 12	12 7	15 11	9 8	16 7	9 2	14 5	9 5	13 11	10 9	18 3	10 10	161 2	23 14
10	Half short-horn	8	April 25	1,278	20 4	13 0	20 6	13 10	20 12	14 8	20 2	12 0	20 0	13 5	20 8	12 4	20 2	11 10	232 10	33 4
			Totals	11,444	144 10	97 0	141 12	102 6	150 10	97 7	149 1	88 7	150 8	93 15	144 3	93 10	154 0	90 14	1,703 13	—
			Means	1,144	14 7	9 11	14 3	10 4	15 1	9 12	14 14	8 14	15 1	9 6	14 7	9 6	15 7	9 1	170 6	24 5

FIVE COWS.—UNSEWAGED OR SEWAGED ITALIAN RYE GRASS.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed. Grass — From which Field, Plot, and Crop					Rye, Plots 2&3, Crop 3.		Rye,* Crop 3.		Rye, Plot 1, Crop 4		Rye, Plot 1, Crop 4.		Rye, Plot 1, Crop 4.		Rye,* Crop 3.		Rye,* Crop 3.		—	—
Quantities weighed (tons. cwts. qrs. lbs.)					0 4 2 14		0 4 2 24½		0 2 1 17½		0 4 0 10		0 3 0 5		0 1 1 2		0 1 1 2		1 1 1 13½	0 0 2 13
Oilcake (cotton-cake) (ditto.)					0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 0 15		0 0 3 21	0 0 0 3
1	Cross short-horn	Aged	April 20	1,130½	17 9	11 7	21 0	12 3	20 6	13 11	14 14	13 0	21 10	12 4	20 0	12 0	16 10	9 11	224 11	32 2
2	Ayrshire	6	Mar. 15	902½	16 2	10 10	17 8	10 9	17 10	11 14	17 5	10 13	17 13	10 0	16 2	10 1	15 10	8 0	190 10	27 4
3	Cross short horn	Aged	Mar. 1	1,160½	15 0	9 11	16 0	10 11	14 12	11 0	14 12	9 4	14 11	9 8	14 2	8 8	14 12	7 12	170 8	24 6
4	Cross short horn	Aged	April 15	1,292½	18 1	12 9	21 8	12 8	20 10	13 5	19 5	11 12	20 12	12 0	19 0	12 10	19 2	10 4	221 6	32 1
5	Cross short-horn	6	Jan. 2	1,294½	12 13	9 2	13 0	9 3	12 12	9 10	12 9	7 1	12 0	6 3	11 14	8 2	12 4	7 14	140 7	20 1

—					Tuesday.		Wednesday.		Thursday.		Friday.									

FIVE COWS.—UNSEWAGED MEADOW GRA[illegible]

Food consumed. Grass	From which Field, Plot, and Crop				Five-acre, Plot 0*, Crop 2.		Five-acre, Plot 0*, Crop 2.		Ten-acre, Plot 0*, Crop 2.		Ten-acre, Plot 0*, Crop 2.		Ten-acre, Plot 0*, Crop 2.		Ten-acre, Plot 1, Crop 2.		Ten-acre, Plot 1, Crop 2.		—	—
	Quantities weighed (tons. cwts. qrs. lbs.)				0 3 3 1½		0 5 3 8½		0 4 3 1		0 5 3 8		0 4 0 7		0 4 3 8½		0 4 3 6		1 11 0 7¼	0 0 3 15
Oilcake (3 parts cotton & 2 parts rape-cake)	(ditto)				0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 1 2 7	0 0 0 5
Yield of Milk, &c. Cows. Nos.	Breed.	Years old.	Dates of Calving.	Weights (Sept. 14) lbs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	A.M. lbs. ozs.	P.M. lbs. ozs.	— lbs. ozs.	— lbs. ozs.
1	Cross short-horn	Aged	May 1	1,199	21 8	13 6	23 0	11 12	21 10	12 7	20 7	13 3	20 4	13 1	21 12	11 13	21 4	13 3	234 5	33 12
2	Cross short-horn	6	Feb. 13	1,253	12 10	8 10	13 1	7 8	11 13	7 10	12 8	7 6	12 14	7 1	11 14	6 11	12 0	6 11	137 2	19 9
3	Cross short-horn	3	April 13	897	15 1	8 14	15 3	8 6	14 0	8 13	14 3	9 0	14 5	8 6	13 1	9 0	14 13	7 9	139 6	22 12
4	Cross short-horn	6	May 20	1,161	21 6	14 1	24 15	12 12	22 14	14 10	22 0	13 10	23 5	14 9	22 4	14 10	21 6	13 5	259 11	37 3
5	Cross short-horn	7	April 17	1,236	17 7	10 5	18 3	8 7	15 2	10 4	17 6	11 0	18 5	10 3	18 13	9 0	18 4	10 0	192 7	27 6
			Totals	5,741	86 0	57 1	[illegible] 4	49 10	85 7	53 12	86 7	56 2	90 1	53 3	87 12	50 1	87 11	49 11	963 1	—
			Means	1,148	17 10	11 6	18 7	9 12	17 1	10 12	17 4	11 4	17 13	10 10	17 9	10 0	17 9	9 15	107 0	28 5

TEN COWS.—SEWAGED MEADOW GRASS.

Food consumed. Grass	From which Field, Plot, and Crop				Five-acre, Plot 2, Crop 3.		Five-acre, Plot 4, Crop 4.		Five-acre, Plot 2, Crop 3.		Ten-acre, Plot 00*, Crop 2.		Ten-acre, Plot 2, Crop 3.		Ten-acre, Plot 2, Crop 3.		Ten-acre, Plot 2, Crop 3.		—	—
	Quantities weighed (tons. cwts. qrs. lbs.)				0 13 2 18		0 14 0 21		0 12 0 17		0 12 0 18		0 17 1 15		0 11 3 10		0 11 3 16		4 13 1 4	0 1 1 9
Oilcake (3 parts cotton & 2 parts rape-cake)	(ditto)				0 0 1 23		0 0 1 23		0 0 1 23		0 0 1 23		0 0 1 23		0 0 1 23		0 0 1 23		0 3 0 14	0 0 0 5
Yield of Milk, &c. 1	Cross short-horn	Aged	Mar. 10	1,198	14 0	10 10	16 8	11 2	16 4	11 0	15 6	11 4	15 10	11 4	15 6	10 0	15 0	9 11	183 7	26 3
2	Cross short-horn	8	June 15	1,294	17 0	12 11	19 0	12 2	18 0	12 8	18 5	12 6	18 1	12 0	18 2	10 13	18 10	11 6	211 5	30 3
3	Cross short-horn	8	Feb. 20	1,174	11 14	9 2	12 10	8 10	12 1	8 10	12 4	9 5	12 3	8 12	11 6	7 8	11 14	7 13	143 15	20 8
4	Cross short-horn	7	Feb. 15	1,050	12 7	9 4	14 0	8 8	12 7	8 12	14 3	9 14	14 0	9 8	14 5	8 10	14 0	8 3	158 1	22 9
5	Ayrshire	8	Feb. 22	1,023	11 0	8 4	12 11	7 10	12 2	10 2	11 12	8 0	12 0	7 10	11 10	7 0	11 7	7 13	139 1	19 14
6	Cross short-horn	6	April 14	1,250	16 10	11 13	19 3	11 0	18 3	7 13	18 8	11 14	17 12	11 8	18 6	11 8	18 0	9 10	202 4	28 14
7	Mongrel	Aged	April 12	893	11 0	8 2	18 0	8 1	12 2	7 6	18 10	7 8	12 0	7 7	11 6	6 14	14 0	7 1	138 11	19 13
8	Cross short-horn	8	April 16	1,190	11 14	8 15	11 6	7 0	11 4	8 10	11 0	8 8	10 14	8 13	10 11	7 7	10 11	8 8	135 9	19 6
9	Cross short-horn	7	April 13	1,087	15 1	10 6	17 10	9 10	16 13	11 3	15 8	11 1	17 5	10 2	15 4	8 1	16 0	13 11	189 10	27 1
10	Half short-horn	8	April 25	1,278	19 8	13 1	21 4	13 8	19 11	13 12	20 14	13 15	20 8	13 14	19 12	12 2	21 10	12 7	233 13	33 11
			Totals	11,444	140 13	109 8	157 4	97 9	148 15	99 15	150 4	103 9	150 4	101 4	146 4	90 14	151 4	95 8	1,737 0	—
			Means	1,144	14 1	10 4	15 12	9 12	14 14	10 0	16 0	10 9	15 1	10 2	14 10	9 1	15 2	9 8	173 11	24 13

FIVE COWS.—UNSEWAGED OR SEWAGED ITALIAN RYE GRASS.

Food consumed. Grass	From which Field, Plot, and Crop				Rye, Plot 0*, Crop 4.		Rye, Plot 0*, Crop 4.		Rye, Plot 0*, Crop 4.		Rye, Plot 0*, Crop 4.		Rye, Plot 0*, Crop 4.		Rye, Plot 0*, Crop 4.		Rye, Plot 0*, Crop 4.		—	—
	Quantities weighed (tons. cwts. qrs. lbs.)				0 5 0 21		0 5 0 13		0 4 0 17		0 7 1 8½		0 5 5 7½		0 5 2 23½		0 5 3 0		2 0 0 3½	1 0 16
Oilcake (3 parts cotton & 2 parts rape-cake)	(ditto)				0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 1 2 7	0 0 5
Yield of Milk, &c. 1	Cross short-horn	Aged	April 20	1,121	17 12	19 10	23 3	11 8	22 10	11 12	21 4	14 1	20 0	13 4	19 7	10 8	19 10	11 6	229 1	32 13
2	Ayrshire	6	Mar. 15	934	15 8	10 9	17 8	9 4	16 1	9 14	15 6	11 9	15 0	11 6	17 2	10 12	17 8	9 14	166 9	23 10
3	Cross short-horn	Aged	Mar. 1	1,186	14 7	9 1	14 12	8 15	14 1	9 6	17 5	10 3	17 9	10 12	14 11	10 0	14 2	8 9	172 5	24 13
4	Cross short-horn	Aged	April 15	1,285	18 5	12 4	19 8	11 10	18 12	13 0	19 0	12 14	19 0	13 6	20 9	11 4	20 0	11 14	220 8	31 8
5	Cross short-horn	6	Jan. 2	1,284	11 10	8 9	12 3	8 8	11 10	8 6	15 6	8 11	13 7	8 14	14 0	7 6	12 10	7 12	146 6	20 13
			Totals	5,750	77 7	59 10	86 15	49 13	83 9	51 6	88 5	56 14	84 0	57 12	85 13	49 14	83 14	49 3	934 15	—

Table X.—*continued.*

Detailed Record of Food consumed, and Milk yielded, by Cows fed on Unsewaged and Sewaged Meadow Grass, and on Italian Rye Grass, with Oilcake in addition. Third Season, 1863; 7 days.—September 22 to September 28.

FIVE COWS.—UNSEWAGED MEADOW GRASS.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed. Grass — From which Field, Plot, and Crop					Five-acre, Plot 0*, Crop 2.		Five-acre, Plot 1, Crop 2.		Five-acre, Plot 1, Crop 2.		Five acre, Plot 1, Crop 2.		—		Ten-acre, Plot 1, Crop 2.		Ten-acre, Plot 1, Crop 2.		—	—
Grass — Quantities weighed (*tons. cwts. qrs. lbs.*)					0 5 1 19		0 4 1 14½		0 2 3 10½		0 5 1 2		—		0 5 0 16		0 5 0 21		1 15 0 20	0 1 0 1
Oilcake (3 parts cotton & 2 parts rape-cake) (*ditto*)					0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 1 2 7	0 0 0 5
Yield of Milk, &c. Cows, Nos.	Breed.	Years old.	Dates of Calving	Weights (Sept. 14) *lbs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	A.M. *lbs. ozs.*	[redacted] *lbs. ozs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	A.M. *lbs. ozs.*	P.M. *lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*
1	Cross short-horn	Aged	May 1	1,204†	20 8	12 12	21 8	18 13	20 12	11 15	21 8	13 7	20 8	12 12	20 4	11 0	20 6	12 14	222 15	32 6
2	Cross short horn	6	Feb. 15	1,272†	11 0	6 11	10 6	7 3	11 0	5 7	11 0	6 10	10 12	8 0	10 0	6 1	11 8	6 8	124 2	17 12
3	Cross short-horn	5	April 13	889†	13 14	8 11	14 11	8 15	14 0	8 11	14 6	9 10	14 7	9 6	14 7	8 8	14 4	9 10	163 8	23 6
4	Cross short horn	5	May 20	1,096†	21 12	14 14	22 8	13 11	22 3	14 4	22 10	13 10	21 11	14 11	21 8	9 12	22 1	14 10	250 13	35 13
5	Cross short horn	7	April 17	1,244†	17 3	10 3	18 1	9 14	17 2	9 2	17 13	10 6	17 3	9 10	17 2	12 4	17 2	9 11	192 11	27 8
			Totals	5,707	84 5	53 2	87 2	58 8	85 1	49 7	87 2	53 11	84 9	54 7	83 5	49 9	86 5	53 8	964 15	—
			Means	1,141	16 14	10 10	17 7	10 11	17 0	9 14	17 7	10 12	16 15	10 14	16 10	9 15	17 4	10 11	193 0	27 9

TEN COWS.—SEWAGED MEADOW GRASS.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed. Grass — From which Field, Plot, and Crop					Five-acre, Plot 4, Crop 4.		Five-acre, Plot 4, Crop 4.		Five acre, Plot 4, Crop 4.		Five-acre, Plot 4, Crop 4.		Ten-acre, Plot 2, Crop 3.		Ten-acre, Plot 2, Crop 3.		Ten-acre, Plot 2, Crop 3.		—	—
Grass — Quantities weighed (*tons. cwts. qrs. lbs.*)					0 14 1 0		0 16 3 21		1 1 0 24		0 17 2 24		0 17 1 6		0 10 1 16		0 10 1 12		5 6 0 19	0 1 2 5
Oilcake (3 parts cotton & 2 parts rape cake) (*ditto*)					0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 3 0 14	0 0 0 5
Yield of Milk, &c. 1	Cross short-horn	Aged	Mar. 10	1,209	15 0	10 3	14 15	10 12	13 0	10 3	14 12	10 12	14 8	10 13	14 2	9 10	15 1	10 7	176 2	25 2
2	Cross short horn	8	June 15	1,094	16 10	11 8	17 12	11 11	17 10	11 6	16 6	11 10	18 7	11 11	17 5	11 5	18 5	11 8	203 3	29 0
3	Cross short horn	6	Feb. 20	1,174	12 1	8 8	12 0	8 6	12 1	8 13	11 12	8 15	11 8	8 10	10 11	7 14	11 12	9 5	142 4	20 5
4	Cross short-horn	7	Feb. 15	1,090	11 14	8 7	14 0	9 2	13 14	9 2	13 13	9 7	13 10	8 11	12 0	8 6	12 8	8 0	158 14	22 0
5	Ayrshire	5	Feb. 22	1,085	11 0	7 0	10 11	7 12	10 13	7 5	11 6	6 4	11 8	7 10	10 12	6 10	11 4	7 3	129 2	18 7
6	Cross short-horn	6	April 14	1,006	17 14	10 12	18 4	12 8	18 12	12 2	20 0	11 0	20 10	11 8	19 0	12 0	20 0	11 15	216 0	30 14
7	Mongrel	Aged	April 12	899	11 12	6 15	11 6	6 6	11 0	6 7	11 2	6 4	10 9	6 6	10 0	6 6	11 10	7 0	121 5	17 10
8	Cross short horn	6	April 16	1,190	10 10	6 1	10 4	6 7	9 4	6 3	9 5	7 14	9 0	6 5	10 6	6 2	11 2	8 7	127 6	18 3
9	Cross short horn	7	April 18	1,087	16 8	10 5	17 1	10 7	16 2	10 5	15 11	11 10	14 11	11 13	15 7	9 14	14 6	11 8	184 10	26 6
10	Half short horn	5	April 25	1,278	21 11	11 15	20 5	14 6	20 2	13 2	21 2	13 0	20 10	13 13	19 11	11 15	21 4	10 13	234 0	33 5
			Totals	11,444	144 0	94 8	148 10	99 5	144 10	97 0	147 5	99 5	145 1	99 6	150 6	93 5	147 4	96 2	1,693 4	—
			Means	1,144	14 6	9 7	14 11	9 15	14 7	9 11	14 12	9 15	14 8	9 15	13 15	9 4	14 12	9 10	169 4	24 3

FIVE COWS.—UNSEWAGED OR SEWAGED ITALIAN RYE GRASS.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed. Grass — From which Field, Plot, and Crop					Rye, Plot 0*, Crop 4		Rye, Plot 2, Crop 5		Rye, Plot 2, Crop 5		‡ Rye, Crop 4, &c		‡ Rye, Crop 4.		‡ Rye, Crop 4.		‡ Rye, Crop 4		—	—
Grass — Quantities weighed (*tons. cwts. qrs. lbs.*)					0 4 2 10½		0 4 2 9		0 4 2 5		0 4 0 6		0 3 2 10		0 3 2 21		0 5 2 21		1 8 3 7¾	0 0 3 8
Oilcake (3 parts cotton & 2 parts rape-cake) (*ditto*)					0 0 0 20		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 1 2 7	0 0 0 5
1	Cross short-horn	Aged	April 20	1,121	20 8	12 0	20 0	12 4	19 14	13 1	19 10	12 6	20 6	13 13	16 7	13 9	16 6	11 4	224 2	32 0
2	Ayrshire	6	Mar. 15	964	17 7	11 0	17 13	10 13	17 10	11 8	17 15	11 9	18 0	10 11	18 2	11 0	16 4	10 5	202 2	28 14

									7 days.	per day.

Five Cows.—Unsewaged Meadow Grass.

Food consumed.																				
Grass	From which Field, Plot, and Crop				Five-acre, Plot 3, Crop 4.		Five-acre, Plot 3, Crop 4.		Five-acre, Plot 3, Crop 4.		Ten-acre, Plot 4, Crop 4.		Ten-acre, Plot 4, Crop 4.		Ten-acre, Plot 4, Crop 4.		Ten-acre, Plot 4, Crop 4.		—	—
Grass	Quantities weighed (tons, cwts, qrs, lbs.)				0 6 2 20		0 9 3 3		0 6 3 22		0 9 2 16		0 6 2 3		0 6 0 6		0 6 0 7		3 6 1 22	0 1 1 16
Oilcake (3 parts cotton & 2 parts rape-cake)	(ditto)				0 0 0 25		0 0 0 28		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 1 2 7	0 0 0 5
Yield of Milk, &c.																				
Cows. Nos.	Breed.	Years old.	Dates of Calving	Weights (Sept. 14) lbs.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	—	—
					lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	Cross short horn	Aged	May 1	1,204*	21 0	13 12	13 14	11 6	19 9	12 8	20 12	11 8	20 14	11 14	22 9	11 9	23 1	9 15	227 13	32 9
2	Cross short horn	6	Feb. 15	1,272*	10 12	6 4	11 0	6 12	10 11	7 7	10 10	6 6	11 0	6 6	10 8	7 1	10 11	6 1	121 6	17 6
3	Cross short horn	5	April 18	999*	16 2	8 13	14 1	8 0	16 7	9 6	15 10	8 13	15 2	9 2	14 15	8 4	15 0	8 1	169 11	24 2
4	Cross short-horn	5	May 20	1,098*	21 14	16 14	25 10	14 12	22 14	16 0	24 6	13 8	23 0	16 6	24 0	14 2	23 15	12 0	247 9	35 2
5	Cross short horn	7	April 17	1,244*	17 8	9 4	17 8	9 1	18 0	10 10	17 0	10 10	18 15	10 4	18 10	9 12	17 0	8 8	189 9	27 1
			Totals	5,707	88 14	53 15	85 13	49 15	88 0	55 10	88 8	50 11	88 15	54 9	90 10	50 11	88 11	44 3	975 2	—
			Means	1,141	17 6	10 13	17 8	10 0	17 8	11 2	17 11	10 2	17 4	10 13	18 9	10 2	17 12	8 13	195 0	27 14

Ten Cows.—Sewaged Meadow Grass.

Food consumed.																				
Grass	From which Field, Plot, and Crop				Five-acre, Plot 3, Crop 4.		Five-acre, Plot 3, Crop 4.		Five-acre, Plot 3, Crop 4.		Ten-acre, Plot 4, Crop 4.		Ten-acre, Plot 4, Crop 4.		Ten-acre, Plot 4, Crop 4.		Ten-acre, Plot 4, Crop 4.		—	—
Grass	Quantities weighed (tons, cwts, qrs, lbs.)				0 13 1 18		0 19 0 5		0 11 1 17		0 19 8 5		0 13 0 2		0 10 0 11		0 10 0 14		4 16 3 18	0 1 1 15
Oilcake (3 parts cotton & 2 parts rape-cake)	(ditto)				0 0 1 21		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 3 0 14	0 0 0 5
Yield of Milk, &c.																				
1	Cross short horn	Aged	Mar 16	1,208	14 11	10 2	13 2	8 13	14 3	10 0	15 8	10 4	15 7	10 13	14 6	9 1	14 1	8 14	171 0	24 7
2	Cross short horn	5	June 15	1,394	17 12	11 8	17 6	9 12	16 10	11 6	17 10	11 0	17 6	11 3	17 4	10 14	17 8	10 0	197 8	28 2
3	Cross short horn	6	Feb. 20	1,174	11 0	8 0	11 10	8 4	11 12	8 0	11 11	8 5	11 14	8 0	11 4	7 7	11 4	7 6	135 13	19 6
4	Cross short horn	7	Feb. 15	1,090	13 4	8 8	13 0	7 11	13 0	8 0	12 2	7 14	12 0	12 6	12 15	7 10	14 0	7 12	150 7	21 8
5	Ayrshire	8	Feb. 22	1,036	10 0	7 14	10 4	7 1	11 6	7 3	10 0	6 15	11 1	7 13	10 10	7 4	11 6	8 11	125 2	17 14
6	Cross short horn	6	April 14	1,096	19 3	11 9	19 12	11 4	18 8	12 11	19 10	12 3	19 6	11 0	19 10	11 0	20 4	10 6	215 2	30 12
7	Mongrel	Aged	April 12	892	11 12	9 8	11 10	6 7	11 0	7 2	11 11	6 8	11 7	6 12	12 0	6 11	11 8	5 2	128 13	18 7
8	Cross short horn	6	April 16	1,190	10 8	4 8	9 0	8 6	10 4	7 6	11 10	7 8	11 0	8 4	11 10	6 2	12 8	7 0	127 10	18 4
9	Cross short horn	7	April 18	1,087	14 6	11 2	14 10	9 14	15 8	9 14	14 6	10 7	14 3	8 10	13 6	10 4	15 2	7 8	169 0	24 2
10	Half short-horn	8	April 25	1,278	19 13	12 9	19 12	13 0	20 0	13 8	20 5	11 14	20 0	13 2	21 3	12 10	20 2	10 15	227 7	32 8
			Totals	11,444	142 8	96 1	142 3	89 8	141 11	94 3	144 5	92 14	143 14	97 15	143 11	90 15	147 11	81 10	1,647 11	—
			Means	1,144	14 3	9 8	14 3	8 15	14 3	9 7	14 7	9 5	14 6	9 13	14 6	9 1	14 12	8 3	164 12	23 9

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

Food consumed.																				
Grass	From which Field, Plot, and Crop				† Rye, Crop 4.		† Rye, Crop 4.		† Rye, Crop 4.		† Rye, Crop 4.		† Rye, Crop 4.		† Rye, Crop 4.		† Rye, Crop 4.		—	—
Grass	Quantities weighed (tons, cwts, qrs, lbs.)				0 2 2 6		0 4 1 4		0 3 3 14		0 5 0 21		0 3 0 8		0 2 2 13		0 2 2 13		1 6 0 25	0 0 3 0
Oilcake (3 parts cotton & 2 parts rape-cake)	(ditto)				0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 1 2 7	0 0 0 5
Yield of Milk, &c.																				
1	Cross short-horn	Aged	April 20	1,121	17 14	11 6	18 6	11 9	18 6	12 10	19 12	10 1	18 15	10 14	18 8	14 7	21 8	10 12	213 13	30 9
2	Ayrshire	6	Mar. 13	934	17 0	10 7	16 13	9 2	17 4	10 6	17 11	10 0	17 0	9 2	17 15	10 11	16 13	10 2	190 6	27 3
3	Cross short horn	Aged	Mar. 1	1,168	15 0	9 2	14 15	9 9	14 8	10 1	16 8	8 8	15 2	9 4	15 1	11 0	15 14	8 10	172 7	24 10
4	Cross short horn	Aged	April 15	1,296	17 1	10 8	17 1	10 0	16 14	10 8	16 4	9 6	17 13	9 9	18 0	11 0	17 2	8 4	191 3	27 5
5	Cross short-horn	6	Jan. 2	1,234	11 2	7 0	12 0	7 5	11 15	7 2	11 7	7 3	10 10	6 9	13 2	7 14	11 12	7 7	128 8	18 15
			Totals	5,750	78 1	48 2	79 3	47 9	78 15	50 11	80 5	44 13	78 7	45 6	80 10	55 6	82 1	45 5	900 5	—

Third Season, 1863; 7 days.—October 6 to October 12.

Five Cows.—Unsewaged Meadow Grass. a

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed. Grass — From which Field, Plot, and Crop					Five-acre, Plot 3, Crop 4.		Ten-acre, Plot 4, Crop 4.		Ten acre, Plot 4, Crop 4.		Ten-acre, Plot 3, Crop 4.		Ten-acre, Plot 3, Crop 4.		Five-acre, Plot 2, Crop 3.		Five-acre, Plot 2, Crop 3.		—	—
Grass — Quantities weighed (tons, cwts, qrs, lbs.)					0 0 3 20		0 5 2 7		0 7 3 9		0 7 3 20		0 11 3 23		0 3 3 0		0 3 2 6		2 6 1 9	0 1 1 15
Oilcake (3 parts cotton & 2 parts rape-cake) (ditto)					0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 1 2 7	0 0 0 5
Cows, Nos.	Breed.	Years old.	Dates of Calving.	Weights (Oct 12) lbs.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	A.M. lbs. oz.	P.M. lbs. oz.	lbs. oz.	lbs. oz.
Yield of Milk, &c. 1	Cross short-horn	Aged	May 1	1,129	18 0	13 2	21 7	13 10	20 14	13 12	23 0	12 4	20 6	11 4	20 11	10 12	20 7	12 6	229 15	32 13
2	Cross short-horn	6	Feb. 15	1,340	11 6	7 0	11 1	6 8	10 2	5 13	10 12	5 10	10 1	5 6	8 0	5 10	9 0	5 1	111 0	15 14
3	Cross short-horn	3	April 13	866	14 1	9 4	15 10	9 9	15 7	9 11	15 10	8 12	14 3	13 1	14 2	8 11	14 13	6 13	171 13	24 9
4	Cross short-horn	8	May 20	1,090	23 3	15 14	24 1	14 2	22 1	14 0	23 12	14 4	23 4	14 2	22 1	12 0	22 0	15 4	257 0	36 12
5	Cross short-horn	7	April 17	1,208	15 6	9 11	16 0	9 12	16 4	10 1	17 9	8 9	17 11	9 7	16 6	9 14	17 10	9 0	183 3	26 3
			Totals	5,583	81 14	53 15	88 3	53 4	84 12	53 11	90 11	49 7	85 9	53 4	81 4	48 15	84 0	48 8	953 3	—
			Means	1,107	16 6	10 13	17 10	10 7	16 15	10 9	18 2	9 14	17 2	10 11	16 4	9 6	16 13	9 11	190 11	27 4

Ten Cows.—Sewaged Meadow Grass.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed. Grass — From which Field, Plot, and Crop					Five-acre, Plot 3, Crop 4.		Ten acre, Plot 4, Crop 4		Ten acre, Plot 4, Crop 4		Ten acre, Plot 3, Crop 4.		Ten-acre, Plot 3, Crop 4.		Five-acre, Plot 2, Crop 3.		Five-acre, Plot 2, Crop 3.		—	—
Grass — Quantities weighed (tons, cwts, qrs, lbs.)					0 13 3 11		0 11 0 13		0 15 2 18		0 15 3 12		1 3 3 22		0 5 0 12		0 5 0 11		4 16 2 15	0 1 1 15
Oilcake (3 parts cotton & 2 parts rape-cake) (ditto)					0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 0 1 22		0 8 0 14	0 0 0 5
Yield of Milk, &c. 1	Cross short-horn	Aged	Mar. 10	1,190	13 10	9 13	14 8	9 15	14 13	9 9	14 10	9 14	14 0	9 2	14 4	9 6	14 6	10 2	168 0	24 0
2	Cross short-horn	5	June 15	1,360	16 4	11 6	18 2	11 0	17 6	11 0	17 12	11 0	16 13	11 1	16 12	11 0	18 2	11 0	198 12	28 6
3	Cross short-horn	6	Feb. 20	1,108	11 0	8 2	11 0	7 10	11 0	7 14	11 10	8 10	12 5	7 10	11 12	7 0	11 10	7 10	134 13	19 4
4	Cross short-horn	7	Feb. 15	1,077	13 1	9 3	13 14	8 14	15 8	9 8	14 6	9 10	13 7	9 1	13 3	8 10	14 0	9 6	159 11	22 13
5	Ayrshire	6	Feb. 22	1,005	10 5	7 12	10 14	7 6	10 12	7 3	10 12	7 4	10 13	6 12	10 12	7 0	11 10	7 4	124 6	18 1
6	Cross short-horn	6	April 14	1,101	17 6	12 2	18 11	11 2	18 0	11 15	19 8	11 11	20 5	10 14	18 6	11 4	20 6	11 6	213 6	30 6
7	Mongrel	Aged	April 12	868	11 0	8 14	12 0	6 12	11 4	7 12	12 4	7 2	12 6	7 0	12 4	7 5	11 12	6 0	131 11	18 13
8	Cross short-horn	6	April 16	1,179	10 11	8 0	10 11	7 4	10 10	7 11	9 11	7 6	10 0	6 12	10 3	6 11	9 0	8 13	123 6	17 10
9	Cross short-horn	7	April 13	1,080	14 2	9 0	13 13	9 [illegible]	18 14	10 8	15 0	9 4	14 4	10 2	14 8	9 6	14 3	7 10	165 0	23 9
10	Half short-horn	8	April 25	1,290	19 3	12 14	19 10	11 10	19 2	12 0	20 8	11 10	19 0	13 0	19 6	12 0	18 0	10 3	218 2	31 3
			Totals	11,396	136 8	95 2	143 2	91 0	140 13	93 0	146 1	93 6	145 5	91 6	141 4	89 12	143 1	89 6	1,659 2	—
			Means	1,133	13 10	9 8	14 5	9 2	14 1	9 5	14 10	9 6	14 8	9 2	14 2	9 0	14 5	8 15	165 15	23 7

Five Cows.—Unsewaged or Sewaged Italian Rye Grass.

					Tuesday.		Wednesday.		Thursday.		Friday.		Saturday.		Sunday.		Monday.		Total in 7 days.	Per head per day.
Food consumed. Grass — From which Field, Plot, and Crop					• Rye, Crop 4.		• Rye, Crop 4.		• Rye, Crop 4.		• Rye, Crop 4.		• Rye, Crop 4.		• Rye, Crop 4.		• Rye, Crop 4.		—	—
Grass — Quantities weighed (tons, cwts, qrs, lbs.)					0 4 3 20		0 5 3 16		0 4 3 24		0 4 1 20		0 6 3 7		0 3 1 12		0 3 1 12		1 13 3 1	0 0 3 24
Oilcake (3 parts cotton & 2 parts rape cake) (ditto)					0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 0 0 25		0 1 3 7	0 0 0 5
Yield of Milk, 1	Cross short-horn	Aged	April 20	1,088	17 4	11 5	19 15	12 0	20 1	11 0	19 12	13 8	20 5	11 4	19 14	10 11	19 6	11 13	216 13	31 0
2	Ayrshire	6	Mar. 18	914	17 6	9 13	17 0	11 5	16 10	9 12	17 15	10 0	17 13	9 0	16 9	9 2	17 10	9 7	189 2	27 0
3	Cross short-horn	Aged	Mar. 1	1,190	14 0	9 6	13 13	9 5	15 4	9 1	14 12	9 6	15 10	8 4	13 0	7 6	14 13	7 0	161 6	23 1
4	Cross short-horn	Aged	April 15	1,220	16 8	11 0	17 1	11 10	18 1	11 4	17 7	11 4	17 12	11 8	17 6	11 1	18 9	11 4	201 4	28 12
5	Cross short-horn	6	Jan. 2	1,300	11 6	7 12	11 6	7 8	10 9	6 8	11 8	6 12	11 6	7 0	10 15	7 7	15 5	7 0	130 14	18 11

TABLE XIX.

RESULTS of the Analyses of 12 Samples of Sewage-water collected in the Ten-acre Field.

Third Season 1862–3; November 1862—May 1863 inclusive.

	GRAINS PER GALLON.												
	1862.				1863.								Mean; 12 Samples.
	November		December		January		February		March		April 7.	May 7 & 8.	
	3–5.	17–19.	1–3.	15–17.	5–7.	19–21	2–4.	16–18.	8	17			
Sample Numbers	1	2	3	4	5	6	7	8	9	10	11	12	
	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Organic matter. In solution	6·20	8·80	6·96	8·36	8·60	10·20	4·35	4·35	5·95	7·65	6·35	7·50	7·11
Organic matter. In suspension	19·12	18·50	25·08	15·75	21·85	15·10	16·25	27·65	10·90	7·40	13·75	20·60	17·66
Organic matter. Total	25·32	27·30	32·04	24·11	30·45	25·30	20·60	32·00	16·85	15·05	20·10	28·10	24·77
Inorganic matter. In solution	34·50	33·50	31·90	28·00	26·30	31·90	29·15	32·50	29·85	31·25	26·20	42·80	31·49
Inorganic matter. In suspension	21·60	24·10	30·33	22·90	34·55	24·50	22·65	37·00	16·70	15·85	30·40	18·50	24·92
Inorganic matter. Total	56·10	57·60	62·23	50·90	60·85	56·40	51·80	69·50	46·55	47·10	56·60	61·30	56·41
Total in solution	40·70	42·30	38·86	36·36	34·90	42·10	33·50	36·85	35·80	38·90	32·55	50·30	38·60
Total in suspension	40·72	42·60	55·41	38·65	56·40	39·60	38·90	64·65	27·60	23·25	44·15	39·10	42·58
Total solid matter	81·42	84·90	94·27	75·01	91·30	81·70	72·40	101·50	63·40	62·15	76·70	89·40	81·18
Ammonia. In solution	4·95	4·90	4·06	2·95	1·91	2·53	3·10	4·60	4·22	5·56	3·41	6·40	4·05
Ammonia. In suspension	1·72	1·65	1·66	1·03	1·46	1·13	0·77	2·84	1·12	0·84	1·63	1·28	1·43
Ammonia. Total	6·67	6·55	5·72	3·98	3·37	3·66	3·87	7·44	5·34	6·40	5·04	7·68	5·48

TABLE XII.

SUMMARY of FOOD consumed, and Milk and Increase yielded, by Cows fed respectively on Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

SECOND SEASON, 862.

Periods.* Dates.*	No. of Days.	3 Cows.—Unsewaged Grass. Average per head per day. Food consumed. Green Grass.	Oil-cake.	Milk yielded.	Average Increase in weight per head per week.	12 Cows.—Sewaged Grass. Average per head per day. Food consumed. Green Grass.	Oil-cake.	Milk yielded.	Average Increase (or Loss) in weight per head per week.
		lbs.	lbs.	lbs. ozs.	lbs. ozs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
May 2 to May 8 - -	7	152	3	31 10	10 2½	133	3	28 4	13 0
„ 9 to „ 15 - -	7	156	3	31 4		175	3	26 7	
„ 16 to „ 22 - -	7	206	3	29 9	29 10½	147	3	25 2	
„ 23 to „ 29 - -	7	168	3	29 7		154	3	25 6	
„ 30 to June 5 - -	7	152	3	28 4	9 12	143	3	23 11	9 0½
June 6 to „ 12 - -	7	142	3	26 6		146	3	22 11	
„ 13 to „ 19 - -	7	160	3	25 8		89	3	22 2	
„ 20 to „ 26 - -	7	146	3	24 15		114	3	21 1	
„ 27 to July 3 - -	7	104	3½	24 0	5 9½	136	3½	20 14	1 1½
July 4 to „ 10 - -	7	125	3½	23 8		137	3½	21 12	
„ 11 to „ 17 - -	7	79	4½	22 13		146	4½	21 7	
„ 18 to „ 24 - -	7	74	4½	22 2		125	4½	21 2	
„ 25 to „ 31 - -	7	161	4	23 4	2 8	113	4	21 3	0 11
Aug. 1 to Aug. 7 - -	7	66	0	21 2		112	0	21 0	
„ 8 to „ 14 - -	7	176	4	21 14		125	4	21 1	
„ 15 to „ 21 - -	7	90	4	22 2		139	4	20 13	
„ 22 to „ 28 - -	7	120	4	22 7	1 8	153	4	29 1	6 2½
„ 29 to Sept. 4 - -	7	99	4	22 0		114	4	19 7	
Sept. 5 to „ 11 - -	7	140	4	22 0		157	4	18 15	
„ 12 to „ 18 - -	7	140	4	21 0		164	4	18 11	
„ 19 to „ 25 - -	7	133	4	20 0	4 14½	136	4	17 8	−1 10½
„ 26 to Oct. 2 - -	7	115	5	18 9		153	5	17 5	
Oct. 3 to „ 9 - -	7	98	5	17 8		141	5	16 0	
„ 10 to „ 16 - -	7	117	5	16 5		160	5	16 5	
May 2 to Oct. 16† -	168	130	3½	23 10	7 6	138	3½	21 3	4 11½

* The dates given are of the "milk yielded," but the periods of the "food consumed" date one day earlier in each case, as also do those of the "average increase (or loss) in weight per head per week."

† It should be observed, that from May 1 to May 15, the first crop of unsewaged meadow grass not being ready to cut, the three cows had Italian rye-grass, and for 20 days, from August 9 to August 28, in default of unsewaged grass, they had green clover; but the figures *given in the bottom line of this Table relate to the whole period, irrespectively of these unavoidable irregularities.*

Table XIII.

Summary of the Weights, Increase (or Loss), and Yield of Milk, of the Cows fed respectively on Unsewaged Meadow Grass, on Sewaged Meadow Grass, and on Italian Rye Grass (Unsewaged and Sewaged), each for Twelve Weeks alone, and each for Twelve Weeks with Oilcake in addition.

TABLE XIII. - - - - -

SUMMARY of the WEIGHTS, INCREASE (or LOSS), and YIELD of MILK, of the Cows fed
ITALIAN RYE GRASS (Unsewaged and Sewaged), each for Twelve

THIRD

Cows. Nos.	TWELVE WEEKS ON GRASS ALONE. Weights. Apr. 27.	May 25.	Inter-mediate. June 8.	June 22.	July 20.	Increase (or Loss) in Weight.	Yield of Milk. First Week.		Last Week.		Average.	
											FIVE COWS.—UNSEWAGE	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
1 *	1,020	1,064	1,062	1,078	1,114	94	207	12	201	14	216	13
2	1,117	1,184	1,177	1,190	1,226	109	235	14	148	4	178	9
3	746	818	821	804	830	84	200	10	144	1	169	12
4 †	1,089	1,096	1,094	1,069	1,09	69	178	0	253	12	231	12
5	1,058	1,112	1,110	1,097	1,142	84	230	0	201	4	222	15
Totals -	5,030	5,274	5,264	5,238	5,404	440	1,052	4	949	3	1,019	13
Averages -	1,006	1,055	1,053	1,048	1,081	88	210	7	189	13	203	15
											TEN COWS.—SEWAGE	
1	1,064	1,136	..	1,121	1,154	90	235	2	197	11	210	9
2 ‡	1,036	1,010	..	1,280	1,384	50	263	3	261	3	263	4
3	1,030	1,060	..	1,066	1,146	116	214	7	174	1	192	7
4	1,036	900	..	906	1,040	4	195	3	163	9	182	2
5	1,002	984	..	1,000	1,029	27	185	9	166	5	174	2
6	880	956	..	958	1,016	136	212	5	202	0	216	3
7	808	838	..	894	892	84	192	0	161	9	182	8
8	960	1,026	..	1,068	1,122	162	159	3	148	0	162	10
9	906	954	..	964	1,046	140	225	10	183	2	213	4
10 §	1,320	1,358	..	1,186	1,226	31	164	15	244	9	175	15
Totals -	10,042	10,312	..	10,533	11,055	840	2,047	9	1,902	1	1,973	0
Averages -	1,004	1,031	..	1,053	1,106	84	204	12	190	3	197	5
											FIVE COWS.—UNSEWAGED O	
1	1,066	1,122	..	1,122	1,140	74	286	6	243	14	288	0
2	874	902	..	878	910	36	262	0	192	12	223	13
3 *	1,042	1,106	..	1,087	1,130	88	** 285	8	165	2	212	11
4	1,185	1,176	..	1,180	1,218	33	280	14	215	7	245	12
5 ¶	1,114	1,048	..	1,128	1,184	−8	210	1	138	15	138	5
Totals -	5,281	5,354	..	5,395	5,582	223	1,324	13	956	2	1,108	9
Averages -	1,056	1,071	..	1,079	1,116	45	264	15	191	4	221	11

* On May 25, No. 1 cow on unsewaged meadow grass, and No. 3 cow on rye-grass were transposed, and t
weights entered in the Table are, from the commencement in each case, those of the newly placed cow.

† The No. 4 cow on unsewaged meadow grass put up at the commencement (April 27) increased 73 l
by May 25, but diminished considerably in yield of milk, and as she was obviously fattening, was th
replaced by the cow whose weight is entered for that date; and in the columns "increase in weigh
and "yield of milk" the results obtained on the two cows, successively, are given.

‡ The No. 2 cow on sewaged meadow grass put up at the commencement (April 27) had lost 54 lbs.
June 22, and being ill was removed June 24, and replaced by the animal whose weight on June 22 is enter
for that date; but in the columns "increase in weight" and "yield of milk" the results obtained on t
two cows, successively, are given.

§ *The No. 10 cow put* up at the commencement (April 27) diminished considerably in yield of milk, a
slipping her calf about June 22, was then replaced by the cow whose weight is entered under that da
but in the columns "increase in weight" and "yield of milk" the results obtained on the two co
successively, are given.

TABLE XIII.

respectively on UNSEWAGED MEADOW GRASS, on SEWAGED MEADOW GRASS, and on Weeks alone, and each for Twelve Weeks with OILCAKE in addition.

SEASON, 1863.

TWELVE WEEKS ON GRASS AND OILCAKE.										TOTAL 24 WEEKS.	
Weights.						Increase (or Loss) in Weight.	Yield of Milk.			Increase in Weight.	Average Yield of Milk per Week
Intermediate. Aug. 3.	Aug. 17.	Intermediate. Sept. 8.	Sept. 14.	Intermediate. Sept. 23.	Oct. 12.		First Week.	Last Week.	Average.		
MEADOW GRASS.††											
lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs. ozs.*	*lbs.*	*lbs. ozs.*
1,138	1,176	1,186	1,199	1,204	1,123	9	220 15	229 15	235 4	103	226 0
1,234	1,253	1,274	1,268	1,272	1,246	20	156 11	111 0	138 6	129	158 8
854	878	890	897	839	866	36	156 10	171 13	169 4	120	169 8
1,118	1,118	1,146	1,141	1,098	1,090	− 2	274 7	257 6	270 6	67	251 1
1,170	1,194	1,267	1,236	1,244	1,208	66	205 1	183 3	195 2	150	209 0
5,514	5,619	5,772	5,741	5,707	5,533	129	1,013 12	953 5	1,008 6	569	1,014 1
1,103	1,124	1,154	1,148	1,141	1,107	26	202 12	190 11	201 11	114	202 13
MEADOW GRASS.											
..	1,182	..	1,208	..	1,190	36	211 11	168 0	189 13	126	200 3
..	1,384	..	1,394	..	1,360	− 24	263 12	196 12	227 7	26	245 5
..	1,182	..	1,174	..	1,163	22	174 5	134 13	153 3	138	172 13
..	1,070	..	1,090	..	1,077	37	173 5	159 11	160 14	41	171 8
..	1,019	..	1,035	..	1,033	4	173 6	126 5	145 1	31	159 9
..	1,048	..	1,096	..	1,101	85	221 6	213 6	211 7	221	213 13
..	884	..	892	..	868	24	175 14	131 11	149 8	60	166 0
..	1,140	..	1,190	..	1,179	57	153 7	123 6	141 7	219	152 1
..	1,010	..	1,067	..	1,060	14	219 13	165 0	193 14	154	203 9
..	1,260	..	1,278	..	1,290	64	266 12	218 2	244 8	95	210 3
..	11,209	..	11,444	..	11,326	271	2,033 11	1,639 2	1,817 2	1,111	1,895 0
..	1,121	..	1,144	..	1,133	27	203 6	163 15	181 11	111	189 8
SEWAGED ITALIAN RYE GRASS.											
..	1,150	1,130	1,121	..	1,088	− 52	258 3	216 13	235 11	22	261 14
..	922	962	934	..	914	4	194 2	189 2	195 1	40	200 7
..	1,146	1,169	1,166	..	1,120	− 10	168 8	161 6	171 9	78	192 2
..	1,271	1,299	1,295	..	1,220	2	223 10	201 4	221 2	35	233 7
..	1,195	1,224	1,234	..	1,200	16	147 6	130 14	142 15	8	140 10
..	5,684	5,754	5,750	..	5,542	− 40	991 13	899 7	966 6	183	1,037 8
..	1,137	1,151	1,150	..	1,108	− 8	198 6	179 14	193 4	37	207 8

¶ The No. 5 cow on rye-grass put up at the commencement (April 27), falling very ill, had lost by May 2 144 lbs., and was replaced by another cow whose weight is given under that date; but in the column "increase in weight" and "yield of milk" the results obtained on the two cows, successively, are given.

** As will be seen by reference to Appendix, Table X. p. 133, the yield of milk of No. 3 cow on rye-gras is only given for four out of the seven days of the first week of the experiment, but in the calculations th yield per diem for the remaining three days is assumed to be the same as that of the average of th ensuing week of the No. 3 cow put up on May 5.

†† From April 27 to June 8, the first crop of unsewaged meadow grass not being ready to cut, the five cow nominally fed on it had Italian rye-grass, and they also received Italian rye-grass from Aug. 2 to Sept. 8 i default of unsewaged grass; but the figures in the columns "increase in weight" and "yield of milk" a irrespective of these unavoidable irregularities.

TABLE XIV.

SUMMARY of FOOD consumed, and Milk and Increase yielded, by Cows fed respectively on Us Meadow Grass, on Sewaged Meadow Grass, and on Italian Rye Grass (Unsewaged and S each for Twelve Weeks alone, and each for Twelve Weeks with Oilcake in addition.

THIRD SEASON, 1863.

Periods.*		5 Cows.—Unsewaged Meadow Grass.				10 Cows.—Sewaged Meadow Grass.				5 Cows.—Unsewag Sewaged Italian Ry		
		Average per head per day.			Average Increase (or Loss) in weight per head per week.	Average per head per day.			Average Increase (or Loss) in weight per head per week.	Average per head per day.		
		Food consumed.		Milk yielded.		Food consumed.		Milk yielded.		Food consumed.		Milk yielded.
Dates.*	No. of Days.	Green Grass.	Oil-cake.			Green Grass.	Oil-cake.			Green Grass.	Oil-cake.	
Twelve Weeks. Grass alone.												
		lbs.	lbs.	lbs. ozs.	lbs. ozs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.	lbs.	lbs.	lbs. ozs.
April 28 to May 4 -	7	112	..	30 1		113	..	29 4		119	..	37 14
May 5 to „ 11 -	7	124	..	28 0		123	..	31 2		151	..	35 14
„ 12 to „ 18 -	7	132	..	28 6	15 8	145	..	31 11	6 13	138	..	32 10
„ 19 to „ 25 -	7	126	..	27 8		145	..	29 12		123	..	33 14
„ 26 to June 1 -	7	109	..	34 0		153	..	29 13		160	..	34 8
June 2 to „ 8 -	7	127	..	32 6		137	..	27 15		168	..	33 3
„ 9 to „ 15 -	7	160	..	30 5	− 1 12½	133	..	25 8	1 8½	167	..	31 10
„ 16 to „ 22 -	7	113	..	29 9		116	..	24 3		175	..	29 13
„ 23 to „ 29 -	7	106	..	27 15		140	..	26 3		163	..	27 14
„ 30 to July 6 -	7	108	..	27 1		170	..	27 11		179	..	27 13
July 7 to „ 13 -	7	50	..	27 8	8 4½	154	..	28 0	12 0½	196	..	27 12
„ 14 to „ 20 -	7	68	..	27 8		158	..	27 3		178	..	27 5
April 28 to „ 20† -	84	110	..	29 2	7 5½	143	..	28 3	7 0	157	..	31 11
Twelve Weeks. Grass and Oilcake.												
July 21 to July 27 -	7	67	3	26 15		157	3	29 1		168	3	28 5
„ 28 to Aug. 3 -	7	54	3	29 11		179	3	29 9		155	3	28 3
Aug. 4 to „ 10 -	7	87	3	30 8	10 13	168	3	28 8	8 13½	134	3	28 11
„ 11 to „ 17 -	7	84	3	30 7		176	3	27 5		104	3	28 15
„ 18 to „ 24 -	7	58	3	30 9		176	3	26 15		96	3	28 6
„ 25 to „ 31 -	7	50	3	29 0		180	3	25 4		90	3	26 2
Sept. 1 to Sept. 7 -	7	73	3	27 10	6 1½	180	3	24 9	8 14	119	3	27 9
„ 8 to „ 14 -	7	110	3	25 2		196	3	24 5		69	3	27 5
„ 15 to „ 21 -	7	90	5	28 2		149	5	24 15		128	5	27 5
„ 22 to „ 28 -	7	118	5	27 9		173	5	24 3		98	5	27 1
„ 29 to Oct. 5 -	7	155	5	27 14	−10 6½	155	5	23 9	− 2 10½	84	5	25 12
Oct. 6 to „ 12 -	7	155	5	27 4		165	5	23 7		106	5	25 11
July 21 to „ 12† -	84	90	3⅔	26 13	2 2½	172	3⅔	25 15	2 4½	112	3⅔	27 10
Twenty-four Weeks. First 12 Weeks, Grass alone. Second 12 Weeks, Grass and Oilcake.												
April 28 to Oct. 12† -	168	100	1⅚	28 15	4 11¾	158	1⅚	27 1	4 10	134	1⅚	29 10

* The dates given are of the "milk yielded," but the periods of the "food consumed" date one day earlier in as also do those of the "average increase (or loss) in weight per head per week."

† From April 27 to June 8, the first crop of unsewaged meadow grass not being ready to cut, the five cows non on it had Italian rye-grass; and they also received Italian rye-grass from Aug. 2 to Sept. 8 in default of unsewage grass, but the figures in these lines relate to the whole period, irrespectively of these unavoidable irregularities.

Table XV.

Results of the Analyses of 17 Samples of Sewage-water collected in the Five-acre Field.

Second Season 1861–2; November 1861—October 1862 inclusive.

—	Nov. 4–6. (1861)	Dec. 17 & 18. (1861)	Jan. 6–8. (1862)	Feb. 3–5.	March 3–5.	April 3–5.	May 8–10.	May 22–24.	June 5–7.	July 10–12.	July 21–26.	August 4–9.	August 20 & 21.	September 1 & 2.	September 22 & 23.	October —	October 13 & 14.	Mean; 17 Samples.
Sample numbers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
	Grains per Gallon.																	
	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Organic matter: In solution	11·60	10·70	8·90	8·40	11·19	6·20	6·82	10·10	7·55	6·60	6·10	7·80	9·78	9·00	8·69	7·00	6·70	8·48
Organic matter: In suspension	25·60	39·30	20·50	11·80	16·05	9·25	20·35	10·90	15·10	13·30	19·70	12·70	14·74	17·70	19·86	9·60	7·63	16·71
Organic matter: Total	37·20	50·00	29·40	20·20	27·24	15·45	27·17	21·00	22·65	19·90	25·80	20·50	24·52	26·70	28·55	16·60	14·33	25·13
Inorganic matter: In solution	47·20	43·00	33·30	30·60	27·21	34·35	31·20	34·60	28·25	27·60	40·30	32·70	36·52	42·40	38·55	33·75	33·51	35·00
Inorganic matter: In suspension	21·00	10·80	12·30	11·40	14·77	9·65	55·15	22·60	32·35	22·40	22·70	19·10	30·02	22·20	28·13	14·70	13·05	21·81
Inorganic matter: Total	68·20	53·80	45·60	42·00	41·98	44·00	86·35	57·20	60·60	50·00	63·00	51·80	66·54	64·60	66·68	48·45	46·56	56·81
Total in solution	58·80	53·70	42·20	39·00	38·40	40·55	38·02	44·70	35·80	34·20	46·40	40·50	46·30	51·40	47·24	40·75	40·21	43·48
Total in suspension	46·60	50·10	32·80	23·20	30·82	18·90	75·50	33·50	47·45	35·70	42·40	31·80	44·76	39·90	47·99	24·30	20·68	38·02
Total solid matter	105·40	103·80	75·00	62·20	69·22	59·45	113·52	78·20	83·25	69·90	88·80	72·30	91·06	91·30	95·23	65·05	60·89	81·44
Ammonia: In solution	8·71	7·07	3·82	4·18	4·49	2·00	2·16	3·35	2·23	3·00	4·28	5·15	4·63	7·38	5·56	4·39	3·31	4·45
Ammonia: In suspension	2·20	2·23	1·25	1·38	1·99	0·55	1·82	0·78	1·13	0·75	1·97	1·66	1·69	1·23	2·13	0·96	0·89	1·45
Ammonia: Total	10·91	9·30	5·07	5·56	6·48	2·55	3·98	4·13	3·36	3·75	6·25	6·81	6·32	8·61	7·69	5·35	4·20	5·90
Phosphoric acid	2·14	1·53	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Potass	4·95	3·28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Soda	9·44	8·53	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table XVI.

Results of the Analyses of 17 Samples of Sewage-water collected in the Ten-acre Field.

Second Season 1861–2; November 1861—October 1862 inclusive.

—	Grains per Gallon.																	
	1861.		1862.															Mean; 17 Samples.
	Nov. 4–6.	Dec. 17.	Jan. 7.	Feb. 11.	March 4.	April 1 & 2.	May 5–7.	May 19–31.	June 2–4.	July 7–12.	July 21–26.	August 4–9.	August 18 & 19.	September 1 & 2.	September 22 & 23.	October —.	October 13 & 14.	
Sample Numbers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Organic matter. In solution	10·60	9·40	9·00	7·00	9·42	6·68	6·20	7·70	8·10	7·40	6·90	9·40	6·70	8·30	5·80	8·79	8·30	7·98
Organic matter. In suspension	30·40	25·40	16·30	8·90	9·88	8·90	33·80	14·45	20·40	17·30	7·00	14·42	12·37	20·42	26·38	13·84	8·20	16·96
Organic matter. Total	41·00	34·80	25·30	15·90	19·30	15·58	40·00	22·15	28·50	24·70	13·90	23·82	19·07	28·72	32·18	22·63	16·50	24·94
Inorganic matter. In solution	48·40	41·70	33·70	32·40	28·18	34·60	28·21	31·10	31·90	28·80	30·10	33·02	34·60	38·90	32·30	35·52	31·70	33·83
Inorganic matter. In suspension	30·65	19·30	8·10	5·80	3·02	6·35	61·10	21·05	26·75	26·90	19·90	15·86	15·34	17·08	37·95	20·12	11·80	20·42
Inorganic matter. Total	79·05	61·00	41·80	38·20	31·20	40·95	89·31	52·15	58·65	55·70	50·00	48·88	49·93	55·98	70·25	55·64	43·50	54·25
Total in solution	59·00	51·10	42·70	39·40	37·60	41·28	34·41	38·80	40·00	36·20	37·00	42·42	41·29	47·20	38·10	44·31	40·00	41·81
Total in suspension	61·05	44·70	24·40	14·70	12·90	15·25	94·90	35·50	47·15	44·20	26·90	30·28	27·71	37·50	64·31	33·96	20·00	37·38
Total solid matter	120·05	95·80	67·10	54·10	50·50	56·53	129·31	74·30	87·15	80·40	63·90	72·70	69·00	84·70	102·41	78·27	60·00	79·19
Ammonia. In solution	8·63	6·25	4·28	4·25	4·56	1·75	3·69	3·06	3·16	3·60	4·38	4·74	4·86	7·09	4·69	4·39	3·27	4·51
Ammonia. In suspension	2·75	1·42	1·51	0·90	0·94	0·96	2·75	1·09	1·52	2·04	1·49	0·82	0·78	1·07	2·76	1·73	0·63	1·48
Ammonia. Total	11·38	7·67	5·79	5·15	5·50	2·71	6·44	4·15	4·68	5·64	5·87	5·56	5·64	8·16	7·45	6·12	3·90	5·99
Phosphoric acid	2·39	1·15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Potass	4·03	3·48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Soda	10·79	8·63	..	..	..	..				..	..	..	..	..	..	..	..	..

COMPARATIVE and *Average Composition of the Sewage-water* collected in —

Second Season 1861–2; November 1861.—*October 1862 inclusive.*

	Nov. 1861, 5-acre field	Nov. 1861, 10-acre field	Dec. 1861, 5-acre field	Dec. 1861, 10-acre field	Jan. 1862, 5-acre field	Jan. 1862, 10-acre field	Feb. 1862, 5-acre field	Feb. 1862, 10-acre field	March 1862, 5-acre field	March 1862, 10-acre field	April 1862, 5-acre field	April 1862, 10-acre field	May 1862, 5-acre field	May 1862, 10-acre field	June 1862, 5-acre field	June 1862, 10-acre field	July 1862, 5-acre field	July 1862, 10-acre field	Aug. 1862, 5-acre field	Aug. 1862, 10-acre field	Sept. 1862, 5-acre field	Sept. 1862, 10-acre field	Oct. 1862, 5-acre field	Oct. 1862, 10-acre field	Average for the 12 months in the two fields
	GRAINS PER GALLON.																								
Number of Analyses	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	2	2	2	2	2	2	2	34
	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.
Organic matter. In solution	11·60	10·60	10·70	9·40	8·90	9·00	8·40	7·00	11·19	9·42	6·20	6·66	8·46	6·95	7·55	8·10	6·35	7·15	8·79	8·05	8·85	7·05	6·85	8·55	8·41
Organic matter. In suspension	25·60	30·40	39·30	25·40	20·50	16·30	11·80	8·90	16·05	9·88	9·25	8·90	15·63	24·13	15·10	20·40	16·50	12·15	13·72	13·40	18·78	23·40	8·62	11·02	17·30
Organic matter. Total	37·20	41·00	50·00	34·80	29·40	25·30	20·20	15·90	27·24	19·30	15·45	15·56	24·09	31·08	22·65	28·50	22·85	19·30	22·51	21·45	27·63	30·45	15·47	19·57	25·71
Inorganic matter. In solution	47·20	48·40	43·00	41·70	33·30	33·70	30·60	32·40	27·21	28·18	34·35	34·60	32·90	29·66	28·25	31·90	33·95	29·45	34·61	33·81	40·48	35·60	33·63	33·61	34·69
Inorganic matter. In suspension	21·00	30·65	10·80	19·30	12·30	8·10	11·40	5·80	14·77	3·02	9·65	6·35	38·88	41·07	32·35	26·75	22·55	23·40	24·56	15·60	25·16	27·51	13·88	15·96	19·20
Inorganic matter. Total	68·20	79·05	53·80	61·00	45·60	41·80	42·00	38·20	41·98	31·20	44·00	40·95	71·78	70·73	60·60	58·65	56·50	52·85	59·17	49·41	65·64	63·11	47·51	49·57	53·89
Total in solution	58·80	59·00	53·70	51·10	42·20	42·70	39·00	39·40	38·40	37·60	40·55	41·26	41·36	36·61	35·80	40·00	40·30	36·60	43·40	41·86	49·33	42·65	40·48	42·16	43·10
Total in suspension	46·60	61·05	50·10	44·70	32·80	24·40	23·20	14·70	30·82	12·90	18·90	15·25	54·51	65·20	47·45	47·15	39·05	35·55	38·28	29·00	43·94	50·91	22·50	26·98	36·50
Total solid matter	106·40	120·05	103·80	95·80	75·00	67·10	62·20	54·10	69·22	50·50	59·45	56·51	95·87	101·81	83·25	87·15	79·35	72·15	81·68	70·86	93·27	93·56	62·98	69·14	79·60
Ammonia. In solution	8·71	8·63	7·07	6·25	3·82	4·28	4·18	4·25	4·49	4·56	2·00	1·75	2·70	3·38	2·23	3·16	3·64	3·99	4·89	4·80	6·47	5·89	3·85	3·83	4·54
Ammonia. In suspension	2·20	2·75	2·23	1·42	1·25	1·51	1·88	0·90	1·99	0·94	0·55	0·96	1·30	1·92	1·13	1·52	1·36	1·77	1·68	0·80	1·68	1·92	0·93	1·18	1·47
Ammonia. Total	10·91	11·38	9·30	7·67	5·07	5·79	6·06	5·15	6·48	5·50	2·55	2·71	4·00	5·30	3·36	4·68	5·00	5·76	6·57	5·60	8·15	7·81	4·78	5·01	6·01

TABLE XVIII.

RESULTS of the Analyses of 13 Samples of Sewage-water collected in the Five-acre Field.
Third Season 1862–3; November 1862—May 1863 inclusive.

—	GRAINS PER GALLON.													
	1862.				1863.									Mean; 13 Samples.
	November		December		January		February		March		April	May		
	6-8.	20-22.	4-6.	18-20.	8-10.	22-24.	5-7.	19-21.	2, & 4-7.	16, & 18-21.	6, 8, & 9.	4-6.	18-20.	
Sample numbers	1	2	3	4	5	6	7	8	9	10	11	12	13	
	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Organic matter. In solution	7·65	7·62	7·32	8·40	7·50	9·90	6·70	5·10	5·60	8·00	6·80	6·75	7·35	7·28
Organic matter. In suspension	25·30	28·40	27·44	13·20	12·40	16·50	11·40	28·55	35·10	14·60	22·35	20·45	13·70	20·72
Organic matter. Total	32·95	36·02	34·76	21·60	19·90	26·40	18·10	33·65	40·70	22·60	29·15	27·20	21·05	28·00
Inorganic matter. In solution	29·75	35·00	31·98	33·22	31·00	34·10	28·35	31·50	33·65	34·10	32·85	41·55	38·00	33·47
Inorganic matter. In suspension	44·02	34·23	40·48	18·22	27·05	29·80	16·65	57·55	64·35	26·45	33·25	17·50	27·50	33·63
Inorganic matter. Total	73·77	69·23	72·46	51·44	58·05	63·90	45·00	89·05	98·00	60·55	66·10	59·05	65·50	67·10
Total in solution	37·40	42·62	39·30	41·62	38·50	44·00	35·05	36·60	39·25	42·10	39·65	48·30	45·35	40·75
Total in suspension	69·32	62·63	67·92	31·42	39·45	46·30	28·05	86·10	99·45	41·05	55·60	37·95	41·20	54·35
Total solid matter	106·72	105·25	107·22	73·04	77·95	90·30	63·10	122·70	138·70	83·15	95·25	86·25	86·55	95·10

Results of the *Analyses of 12 Samples of Sewage-water collected in the Ten-acre Field.*

Third Season 1862–3; November 1862—*May 1863 inclusive.*

	Grains per Gallon.												
	1862.				1863.								Mean; 12 Samples.
	November		December		January		February		March		April 7.	May 7 & 8.	
	3–5.	17–19.	1–3.	15–17.	5–7.	19–21	2–4.	16–18.	8	17			
Sample Numbers	1	2	3	4	5	6	7	8	9	10	11	12	
	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Organic matter. In solution	6·20	8·80	6·96	8·36	8·60	10·20	4·35	4·35	5·95	7·65	6·35	7·50	7·11
Organic matter. In suspension	19·12	18·50	25·08	15·75	21·85	15·10	16·25	27·65	10·90	7·40	13·75	20·60	17·66
Total	25·32	27·30	32·04	24·11	30·45	25·30	20·60	32·00	16·85	15·05	20·10	28·10	24·77
Inorganic matter. In solution	34·50	33·50	31·90	28·00	26·30	31·90	29·15	32·50	29·85	31·25	26·20	42·80	31·49
Inorganic matter. In suspension	21·60	24·10	30·33	22·90	34·55	24·50	22·65	37·00	16·70	15·85	30·40	18·50	24·92
Total	56·10	57·60	62·23	50·90	60·85	56·40	51·80	69·50	46·55	47·10	56·60	61·30	56·41
Total in solution	40·70	42·30	38·86	36·36	34·90	42·10	33·50	36·85	35·80	38·90	32·55	50·30	38·60
Total in suspension	40·72	42·60	55·41	38·65	56·40	39·60	38·90	64·65	27·60	23·25	44·15	39·10	42·58
Total solid matter	81·42	84·90	94·27	75·01	91·30	81·70	72·40	101·50	63·40	62·15	76·70	89·40	81·18
Ammonia. In solution	4·95	4·90	4·06	2·95	1·91	2·53	3·10	4·60	4·22	5·56	3·41	6·40	4·05
Ammonia. In suspension	1·72	1·65	1·66	1·03	1·46	1·13	0·77	2·84	1·12	0·84	1·63	1·28	1·43
Total	6·67	6·55	5·72	3·98	3·37	3·66	3·87	7·44	5·34	6·40	5·04	7·68	5·48

TABLE XX.

RESULTS of the Analyses of 10 Mixed Samples of Sewage-water, each collected partly in the Five-acre and partly in the Ten-acre Field.

Third Season 1863; June—October inclusive.

—	Grains per Gallon.										
	1863.										Mean 10 Samples.
	June		July		August		September		October		
	1-6.	15-19.	8-10.	20-24.	3-7.	17-21.	7-11.	21-25.	5-9.	19-24.	
Sample Numbers	1	2	3	4	5	6	7	8	9	10	
	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Organic matter. In solution	8·50	7·15	9·10	9·00	13·00	9·90	9·30	8·50	11·10	11·70	9·73
Organic matter. In suspension	28·15	19·00	22·00	36·80	24·30	34·40	76·30	31·60	52·10	36·10	35·97
Total	36·65	26·15	31·10	45·80	37·30	44·30	85·60	40·10	63·20	47·80	45·70
Inorganic matter. In solution	45·70	38·15	46·20	43·20	40·50	52·10	47·30	54·40	54·10	53·50	47·52
Inorganic matter. In suspension	43·50	23·65	36·20	21·00	33·10	25·10	137·00	49·60	61·80	38·40	46·93
Total	89·20	61·80	82·40	64·20	73·60	77·20	184·30	104·00	115·90	91·90	94·45
Total in solution	54·20	45·30	55·30	52·20	53·50	62·00	56·60	62·90	65·20	65·20	57·25
Total in suspension	71·65	41·65	58·20	57·80	57·40	59·50	213·30	81·20	113·90	74·50	82·90
Total solid matter	125·85	86·95	113·50	110·00	110·90	121·50	269·90	144·10	179·10	139·70	140·15
			7·23	6·46	6·75	7·47	7·40	10·21	9·76	8·37	7·66
				3·79	2·57	1·84	4·74	2·35	3·05	2·77	2·65

TABLE XXII.

RESULTS of the Analyses of 8 Samples of Drainage-water collected in the Five-acre Field.

Second Season 1862; May—October inclusive.

—	Grains per Gallon.								
	1862.								Mean; 8 Samples.
	May 6–16.	July 21–26.	August		September		October		
			4–9.	20 and 21.	1 & 2.	22 & 23.	—	13 & 14.	
Sample Numbers	1	2	3	4	5	6	7	8	
Organic matter: In solution	Grains. 5·60	Grains. 10·50	Grains. 8·50	Grains. 6·04	Grains. 6·10	Grains. 6·70	Grains. 8·20	Grains. 5·90	Grains. 7·18
Organic matter: In suspension	*	*	2·49	2·65	1·90	2·70	1·00	0·42	1·40
Organic matter: Total	5·60	10·50	10·99	8·69	8·00	9·40	9·20	6·32	8·58
Inorganic matter: In solution	25·10	31·70	34·21	36·94	39·90	39·00	35·00	34·09	34·50
Inorganic matter: In suspension	*	*	7·48	2·77	0·40	0·90	0·80	2·09	1·81
Inorganic matter: Total	25·10	31·70	41·69	39·71	40·30	39·90	35·80	36·18	36·31
Total in solution	30·70	42·20	42·71	42·98	46·00	45·70	43·20	39·99	41·68
Total in suspension	*	*	9·97	5·42	2·30	3·60	1·80	2·51	3·21
Total solid matter	30·70	42·20	52·68	48·40	48·30	49·30	45·00	42·50	44·89
Ammonia: In solution	0·60	1·68	2·03	1·21	0·30	0·37	0·25	0·54	0·80
Ammonia: In suspension	—	—	0·76	0·23	0·15	0·33	0·23	0·15	0·24

RESULTS of the Analyses of 11 Samples of Drainage-water collected in the Ten-acre Field.

Second Season 1862 ; May—October inclusive.

	GRAINS PER GALLON.											
	1862.											Mean; 11 Samples.
	May		June	July		August		September		October		
	5–7.	19–21.	2–4.	7–12.	21–26.	4–9.	18 & 19.	1 & 2.	22 & 23.	—	13 & 14.	
Sample Numbers	1	2	3	4	5	6	7	8	9	10	11	
	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Organic matter — In solution	5·70	7·60	9·30	5·10	9·90	6·16	8·92	7·40	7·10	11·41	7·50	7·83
Organic matter — In suspension	*	*	*	*	*	2·13	0·59	1·20	4·20	2·87	4·30	1·39
Organic matter — Total	5·70	7·60	9·30	5·10	9·90	8·29	9·51	8·60	11·30	14·28	11·80	9·22
Inorganic matter — In solution	33·30	36·80	37·30	33·70	32·90	31·02	38·38	46·30	42·00	38·33	38·10	37·10
Inorganic matter — In suspension	*	*	*	*	*	10·81	5·88	8·70	6·90	6·01	2·80	3·74
Inorganic matter — Total	33·30	36·80	37·30	33·70	32·90	41·83	44·26	55·00	48·90	44·34	40·90	40·84
Total in solution	39·00	44·40	46·60	38·80	42·80	37·18	47·30	53·70	49·10	49·74	45·60	44·93
Total in suspension	*	*	*	*	*	12·94	6·47	9·90	11·10	8·88	7·10	5·13
Total solid matter	39·00	44·40	46·60	38·80	42·80	50·12	53·77	63·60	60·20	58·62	52·70	50·06
Ammonia — In solution	1·45	1·64	1·52	1·66	1·66	2·25	1·68	3·79	1·57	1·92	1·18	1·85
Ammonia — In suspension	—	—	—	—	—	0·39	0·60	0·60	1·04	0·54	0·45	0·33
Ammonia — Total	1·45	1·64	1·52	1·66	1·66	2·64	2·28	4·39	2·61	2·46	1·63	2·18

* Too small for estimation.

Table XXIV.

Comparative and average Composition of the Drainage-water collected in the Two Fields.

Second Season 1862; May—October inclusive.

—	Grains per Gallon. 1862. May. 5-acre Field.	May. 10-acre Field.	June. 5-acre Field.	June. 10-acre Field.	July. 5-acre Field.	July. 10-acre Field.	August. 5-acre Field.	August. 10-acre Field.	September. 5-acre Field.	September. 10-acre Field.	October. 5-acre Field.	October. 10-acre Field.	Average for the 6 Months in the 2 Fields.
Number of Analyses	1	2	†	1	1	2	2	2	2	2	2	2	19
	Grains.	Grains.		Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Organic matter. In solution	5·50	6·65		9·30	10·50	7·50	7·27	7·54	6·40	7·25	7·05	9·45	7·67
Organic matter. In suspension	*	*		*	*	*	2·57	1·36	2·30	2·70	0·71	3·59	1·20
Organic matter. Total	5·50	6·65		9·30	10·50	7·50	9·84	8·90	8·70	9·95	7·76	13·04	8·87
Inorganic matter. In solution	25·20	35·05		37·30	31·70	33·30	35·58	34·70	39·45	44·15	34·54	38·21	35·38
Inorganic matter. In suspension	*	*		*	*	*	5·12	8·35	0·65	7·80	1·45	4·41	2·53
Inorganic matter. Total	25·20	35·05		37·30	31·70	33·30	40·70	43·05	40·10	51·95	35·99	42·62	37·91
Total in solution	30·70	41·70		46·60	42·20	40·80	42·85	42·24	45·85	51·40	41·59	47·66	43·05
Total in suspension	*	*		*	*	*	7·69	9·71	2·95	10·50	2·16	8·00	3·73
Total solid matter	30·70	41·70		46·60	42·20	40·80	50·54	51·95	48·80	61·90	43·75	55·66	46·78
Ammonia. In solution	0·60	1·55		1·52	1·03	1·66	1·62	1·97	0·38	2·68	0·40	1·55	1·36
Ammonia. In suspension	—	—		—	—	—	0·50	0·49	0·27	0·82	0·19	0·50	0·25
Ammonia. Total	0·60	1·55		1·52	1·03	1·66	2·12	2·46	0·65	3·50	0·59	2·05	1·61

* Too small for estimation.

TABLE XXV.

RESULTS of the Analyses of 21 Samples of Drainage-water collected in the Five-acre Field.

Third Season 1862-3; November 1862—October 1863 inclusive.

—	GRAINS PER GALLON.																					
	1862.				1863.																	Mean; 21 Samples.
	November		December		January		February		March		April	May	June		July		Aug.	September		October.		
	6-8.	20-22.	4-6.	18-20.	8-10.	22-24.	5-7.	19-21.	2, and 4-7.	18, and 16-21.	6, 8, and 9.	18-20.	1-4.	15-17.	8, 9, and 10.	20-22.	3-5.	7-9.	21-23.	5-7.	19, 21, and 24.	
Sample numbers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.
Organic matter. In solution	5·65	7·59	9·91	9·25	9·06	9·10	10·60	5·65	4·25	4·20	5·40	10·25	10·30	5·70	11·00	8·20	5·80	6·30	6·00	7·30	5·20	7·46
Organic matter. In suspension	0·47	1·36	2·22	1·30	2·30	*	0·40	0·20	*	*	..	2·25	0·35	0·85	2·95	3·30	7·80	0·10	1·00	1·00	1·70	1·41
Organic matter. Total	6·12	8·95	12·13	10·55	11·36	9·10	11·00	5·85	4·25	4·20	5·40	12·50	10·65	6·55	13·95	11·50	13·60	6·40	7·00	8·30	6·90	8·87
Inorganic matter. In solution	39·35	38·89	36·02	35·50	29·25	33·10	32·00	34·25	36·80	36·75	34·50	39·30	41·75	35·00	44·30	36·80	44·10	37·20	49·10	49·00	46·60	38·56
Inorganic matter. In suspension	1·58	10·33	2·10	0·30	0·60	*	2·90	1·65	*	*	0·15	2·20	0·20	0·35	4·95	4·80	3·10	2·70	3·20	1·20	2·60	2·14
Inorganic matter. Total	40·93	49·22	38·12	35·80	29·85	33·10	34·90	35·90	36·80	36·75	34·65	41·50	41·95	35·35	49·25	41·60	47·20	39·90	52·30	50·20	49·20	40·69
Total in solution	45·00	46·48	45·93	44·75	38·30	42·20	42·60	39·90	41·05	40·95	39·90	49·55	52·05	40·70	55·30	45·00	49·90	43·50	55·10	56·30	51·80	46·01
Total in suspension	2·05	11·69	4·32	1·00	2·90	*	3·30	1·85	*	*	0·15	4·45	0·55	1·20	7·90	8·10	10·90	2·80	4·20	2·20	4·30	3·55
Total solid matter	47·05	58·17	50·25	46·35	41·20	42·20	45·90	41·75	41·05	40·95	40·05	54·00	52·60	41·90	63·20	53·10	60·80	46·30	59·30	58·50	56·10	49·56
Ammonia. In solution	0·[illegible]	0·94	1·55	0·94	0·89	0·17	0·85	1·37	0·40	0·64	0·33	1·70	0·43	0·40	0·50	0·90	0·31	0·17	0·30	0·30	0·97	0·69
Ammonia. In suspension	none	0·62	0·04*	0·14	0·19	..	0·32	0·10	..	..	..	..	0·34†	0·03	0·27	0·13	0·07	0·13	0·50	0·27	0·08	0·15
Ammonia. Total	0·33	1·56	1·59	1·08	1·08	0·17	1·17	1·47	0·40	0·64	0·33	1·70	0·77	0·43	0·77	1·03	0·[illegible]	0·30	0·80	0·57	1·05	0·84

* Too small for estimation.

Table XXVI.

Results of the Analyses of 22 Samples of Drainage-water collected in the Ten-acre [redacted]

Third Season 1862–3; November 1862—October 1863 inclusive.

Grains per Gallon.

—	1862. November 3–5.	November 17 19.	December 1–3.	December 16–17.	[redacted] January 5–7.	January 19–21.	February 2–4.	February 16–19.	Mar. 8	April 7.	May 7 & 8.
Sample Numbers -	1	2	3	4	5	6	7	8	9	10	11
	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.
Organic matter. In solution -	10·20	10·20	6·90	7·40	7·90	10·40	5·65	5·50	6·10	5·25	8·80
Organic matter. In suspension	1·85	0·79	4·45	2·32	1·00	1·20	1·95	5·80	1·60	1·85	8·45
Organic matter. Total -	12·05	10·99	11·35	9·72	8·90	11·60	7·60	11·30	7·70	7·10	17·25
Inorganic matter. In solution -	36·60	35·60	38·15	38·40	33·30	33·60	34·05	33·85	34·45	33·40	43·80
Inorganic matter. In suspension	4·20	6·11	4·35	2·10	6·80	2·40	2·85	7·25	3·35	1·90	7·45
Inorganic matter. Total -	40·80	41·71	42·50	40·50	40·10	36·00	36·90	41·10	37·80	35·30	51·25
Total in solution -	46·80	45·80	45·05	45·80	41·20	44·00	39·70	39·35	40·55	38·65	52·60
Total in suspension -	6·05	6·90	8·80	4·42	7·80	3·60	4·80	13·05	4·95	3·75	15·90
Total solid matter -	52·85	52·70	53·85	50·22	49·00	47·60	44·50	52·40	45·50	42·40	68·50
Ammonia. In solution -	1·14	3·40	1·47	1·43	1·08	0·80	1·17	1·50	1·12	0·46	3·87
Ammonia. In suspension	0·75	0·29	0·67	0·13	0·19	0·31	0·20	0·19	0·19	0·19	0·55
Ammonia. Total -	1·89	3·69	2·14	1·56	1·27	1·11	1·37	1·69	1·31	0·65	4·42

—	May 14 & 15.	June 1–6.	June 18 & 19.	July 7 & 9.	July 23&24.	August 6 & 7.	August 20&21.	September 10&11.	September 24&25.	October 8 & 9.	October 21–24.	Mean; 22 Samples.
Sample Numbers -	12	13	14	15	16	17	18	19	20	21	22	
	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.
Organic matter. In solution -	9·20	7·75	8·50	9·90	8·50	8·60	10·30	7·50	6·30	8·00	6·70	7·98
Organic matter. In suspension	0·60	3·90	1·50	3·40	2·50	3·90	5·70	5·00	2·90	6·60	5·10	3·29
Organic matter. Total -	9·80	11·65	10·00	13·30	11·00	12·50	16·00	12·50	9·20	14·60	11·80	11·27
Inorganic matter. In solution -	45·30	46·75	38·90	50·10	47·20	52·10	31·40	53·50	54·25	53·40	42·00	41·35
Inorganic matter. In suspension	0·95	1·20	4·35	6·25	6·00	0·50	6·80	1·60	2·65	5·10	2·10	3·94
Inorganic matter. Total -	46·25	47·95	43·25	56·35	53·20	52·60	38·20	55·10	56·90	58·50	44·10	45·29
Total in solution -	54·50	54·50	47·40	60·00	55·70	60·70	41·70	60·70	60·55	61·40	48·70	49·33
Total in suspension -	1·55	5·10	5·85	9·65	8·50	4·40	12·50	6·60	5·55	11·70	7·20	7·23
Total solid matter -	56·05	59·60	53·25	69·65	64·20	65·10	54·20	67·30	66·10	73·10	55·90	56·56
Ammonia. In solution -	2·11	3·11	2·00	1·64	1·67	1·95	0·50	2·37	2·65	3·75	3·09	1·85
Ammonia. In suspension	..	0·10	0·07	0·57	0·13	0·19	0·37	0·43	0·20	0·89	0·12	0·31
Ammonia. Total -	2·11	3·21	2·07	2·21	1·80	2·14	0·87	2·80	2·85	4·64	3·21	2·16

COMPARATIVE and Average Composition of the Drainage-water collected in the Two Fields.

Third Season 1862–3; November 1862—October 1863 inclusive.

GRAINS PER GALLON.

	1862. November. 5-acre Field.	November. 10-acre Field.	December. 5-acre Field.	December. 10-acre Field.	1863. January. 5-acre Field.	January. 10-acre Field.	February. 5-acre Field.	February. 10-acre Field.	March. 5-acre Field.	March. 10-acre Field.	April. 5-acre Field.	April. 10-acre Field.
Number of Analyses -	2	2	3	2	2	2	2	2	2	1	1	1
	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.
Organic matter. In solution -	6·62	10·20	9·58	7·15	9·08	9·15	8·13	5·58	4·22	6·10	5·40	5·25
Organic matter. In suspension	0·92	1·32	1·76	3·39	1·15	1·10	0·30	3·87	..	1·60	..	1·85
Organic matter. Total -	7·54	11·52	11·34	10·54	10·23	10·25	8·43	9·45	4·22	7·70	5·40	7·10
Inorganic matter. In solution -	39·12	35·10	35·76	38·28	31·17	33·45	33·12	33·95	36·78	34·45	34·50	33·40
Inorganic matter. In suspension	5·95	6·16	1·20	3·22	0·30	4·60	2·28	5·05	..	3·35	0·15	1·90
Inorganic matter. Total -	45·07	41·26	36·96	41·50	31·47	38·05	35·40	39·00	36·78	37·80	34·65	35·30
Total in solution -	45·74	45·30	45·34	45·43	40·25	42·60	41·25	39·53	41·00	40·55	39·90	38·65
Total in suspension -	6·87	6·48	2·96	6·61	1·45	5·70	2·58	8·92	..	4·95	0·15	3·75
Total solid matter -	52·61	52·78	48·30	52·04	41·70	48·30	43·83	48·45	41·00	45·50	40·05	42·40
Ammonia. In solution -	0·64	2·27	1·25	1·45	0·53	0·94	1·11	1·34	0·52	1·13	0·33	0·46
Ammonia. In suspension	0·31	0·52	0·09	0·40	0·10	0·25	0·21	0·19	..	0·18	..	0·19
Ammonia. Total -	0·95	2·79	1·34	1·85	0·63	1·19	1·32	1·53	0·52	1·31	0·33	0·65

	1863. May. 5-acre Field.	May. 10-acre Field.	June. 5-acre Field.	June. 10-acre Field.	July. 5-acre Field.	July. 10-acre Field.	August. 5-acre Field.	August. 10-acre Field.	September. 5-acre Field.	September. 10-acre Field.	October. 5-acre Field.	October. 10-acre Field.	Average for the 12 months in the two fields.
Number of Analyses -	1	2	2	2	3	2	1	2	3	3	3	3	43
	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.	Gns.
Organic matter. In solution -	10·25	9·00	8·00	8·13	9·60	9·20	5·80	9·45	6·18	6·90	6·25	7·35	7·61
Organic matter. In suspension	2·25	4·53	0·60	2·70	3·12	3·95	7·80	4·80	0·55	3·95	1·35	5·85	2·40
Organic matter. Total -	12·50	13·53	8·60	10·83	12·72	13·15	13·60	14·25	6·73	10·85	7·60	13·20	10·01
Inorganic matter. In solution -	39·30	44·55	38·37	43·62	40·65	48·65	44·10	41·75	43·15	53·72	47·80	47·70	39·69
Inorganic matter. In suspension	2·20	4·20	0·28	2·78	4·68	6·13	3·10	3·65	2·95	2·28	1·90	3·60	2·96
Inorganic matter. Total -	41·50	48·75	38·65	46·00	45·43	54·78	47·20	45·40	46·10	56·00	49·70	51·30	42·65
Total in solution -	49·55	53·55	46·87	50·95	50·15	57·85	49·90	51·20	49·30	60·62	54·05	55·05	47·30
Total in suspension -	4·45	8·73	0·88	5·48	8·00	9·08	10·90	8·45	3·50	6·23	3·25	9·45	5·36
Total solid matter -	54·00	62·28	47·25	56·43	58·15	66·93	60·80	59·65	52·80	66·85	57·30	64·50	52·66
Ammonia. In solution -	1·70	2·99	0·41	2·56	0·70	1·66	0·31	1·23	0·24	2·21	0·68	2·93	1·23
Ammonia. In suspension	..	0·28	0·19	0·08	0·20	0·35	0·07	0·28	0·31	0·32	0·13	0·51	0·22
Ammonia. Total -	1·70	3·27	0·60	2·64	0·90	2·01	0·38	1·51	0·55	2·53	0·81	3·43	1·45

TABLE XXVIII.

DETAILS of the Sampling, and of the Determinations of Dry Substance and Mineral Matter (Ash), in the Unsewaged and in the Sewaged Meadow Grass.

Second Season, 1862.

Fields.	Plots.	Number of Samples taken.	Weights. In Fresh State. Each Sample.	Weights. In Fresh State. Total.	Weights. Air-dried. Total.	Weights. Air-dried. Taken.	Actual Weights. Air-dried.	Actual Weights. Equal in Fresh State.	Actual Weights. Dry Substance (at 212° Fahr.)	Actual Weights. Mineral Matter (Ash).	Per-centages. Dry in Fresh. Each Expert.	Dry in Fresh. Mean.	Ash in Fresh. Each Expert.	Ash in Fresh. Mean.	Ash in Dry. Each Expert.	Ash in Dry. Mean.
FIRST CROP.																
			lbs.	lbs.	lbs. ozs.	ozs.	ozs.	ozs.	ozs.	ozs.						
Five-acre	1 (Unsewaged)	44	2½	110	25 0	50	12·5	39·286	10·474	0·946	26·66	26·67	2·408	2·406	9·032	9·019
							12·5	39·284	10·480	0·944	26·68		2·403		9·006	
	2 (Sewaged)	23	5	125	32 8	50	12·5	48·077	10·930	0·920	22·75	22·75	1·914	1·920	8·417	8·442
							12·5	48·077	10·940	0·926	22·76		1·920		8·464	
	3 (Sewaged)	17	5	85	14 10	50	12·5	72·650	10·440	1·010	14·37	14·41	1·390	1·390	9·674	9·651
							12·5	72·650	10·490	1·010	14·44		1·390		9·629	
	4 (Sewaged)	23	5	115	20 13	50	12·5	69·069	10·537	0·974	15·26	15·28	1·410	1·424	9·244	9·323
							12·5	69·069	10·565	0·998	15·30		1·433		9·399	
	0* (Unsewaged)	27	2½	67½	17 0	50	12·5	49·632	10·750	0·966	21·66	21·64	1·946	1·946	8·986	8·995
							12·5	49·632	10·730	0·966	21·62		1·946		9·003	
	0* (Unsewaged)	8	2½	20	5 12	50	12·5	43·476	10·256	1·015	23·59	23·62	2·335	2·345	9·897	9·929
							12·5	43·476	10·280	1·024	23·64		2·355		9·961	
Ten-acre	1 (Unsewaged)	34	2½	85	26 8	50	12·5	40·094	10·780	1·013	26·89	26·86	2·527	2·520	9·397	9·380
							12·5	40·094	10·755	1·007	26·82		2·512		9·363	
	2 (Sewaged)	20	5	100	22 12	50	12·5	54·045	10·753	1·010	19·57	19·52	1·839	1·835	9·393	9·398
							12·5	54·045	10·700	1·006	19·47		1·831		9·402	
	3 (Sewaged)	14	5	70	11 4	50	12·5	77·778	10·470	1·190	13·46	13·51	1·530	1·537	11·366	11·370
							12·5	77·778	10·530	1·206	13·54		1·543		11·374	

Table XXVIII.—*continued.*

Details of the Sampling, and of the *Determinations of Dry Substance and Mineral* Matter (Ash), in the Unsewaged and in the Sewaged Meadow Grass.

Second Season, *1862.*

Particulars of Sampling.							Determinations of Dry Substance and Mineral Matter (Ash).									
			Weights.				Actual Weights.				Per-centages.					
Fields.	Plots.	Number of Samples taken.	In Fresh State. Each Sample.	In Fresh State. Total.	Air-dried. Total.	Air-dried. Taken.	Air-dried.	Equal in Fresh State.	Dry Substance (212° Fahr.)	Mineral Matter (Ash).	Dry in Fresh. Each Exper^t.	Dry in Fresh. Mean.	Ash in Fresh. Each Exper^t.	Ash in Fresh. Mean.	Ash in Dry. Each Exper^t.	Ash in Dry. Mean.
Second Crop.																
			lbs.	*lbs.*	*lbs. ozs.*	*ozs.*	*ozs.*	*ozs.*	*ozs.*	*ozs.*						
Five-acre	1 (Unsewaged) - -	8	2½	20	5 8	50	12·5	45·455	10·338	0·930	22·74	22·75	2·046	2·046	8·996	8·993
							12·5	45·455	10·345	0·930	22·76		2·046		8·990	
	2 (Sewaged) - -	14	5	70	12 10	50	12·5	69·307	9·986	1·180	14·41	14·31	1·703	1·717	11·817	12·004
							12·5	69·307	9·843	1·200	14·20		1·731		12·191	
	3 (Sewaged) - -	16	5	80	16 0	50	12·5	62·500	10·278	1·070	16·44	16·42	1·712	1·704	10·411	10·376
							12·5	62·500	10·250	1·060	16·40		1·696		10·341	
	4 (Sewaged) - -	10	5	50	12 0	50	12·5	52·083	10·085	1·043	19·36	19·39	2·003	2·015	10·342	10·390
							12·5	52·083	10·108	1·055	19·41		2·026		10·437	
	0* (Unsewaged) - -	30	2½	75	10 6	50	12·5	48·387	10·189	1·256	21·06	21·06	2·596	2·580	12·327	12·249
							12·5	48·387	10·189	1·240	21·06		2·563		12·170	
Ten-acre	1 (Unsewaged) - -	15	2½	37½	8 4	50	12·5	56·812	10·150	1·200	17·87	17·90	2·112	2·091	11·823	11·683
							12·5	56·812	10·188	1·176	17·93		2·070		11·543	
	2 (Sewaged) - -	8	5	40	8 0	50	12·5	62·500	10·085	1·160	16·14	16·15	1·856	1·859	11·502	11·512
							12·5	62·500	10·095	1·163	16·15		1·861		11·521	
	3 (Sewaged) - -	6	5	30	6 6	50	12·414†	58·419	11·180†	1·126	19·14	18·96	1·927	1·917	10·072	10·115
							12·5	58·824	11·046	1·122	18·78		1·907		10·158	
	4 (Sewaged) - -	13	5	65	12 14	50	12·5	63·107	10·560	1·066	16·73	16·73	1·689	1·685	10·095	10·071
							12·5	63·107	10·550	1·060	16·72		1·680		10·047	

* Designated Plot "0" when unmeasured land.
† 0·086 oz. of dirt was found in this sample, and that weight is therefore deducted.

Table XXVIII.—*continued.*

Details of the Sampling, and of the Determinations of Dry Substance and Mineral Matter (Ash), in the Unsewaged and in the Sewaged Meadow Grass.

Second Season, 1862.

Particulars of Sampling.							Determinations of Dry Substance and Mineral Matter (Ash).									
Fields.	Plots.	Number of Samples taken.	Weights. In Fresh state. Each Sample.	Weights. In Fresh state. Total.	Weights. Air-dried. Total.	Weights. Air-dried. Taken.	Actual Weights. Air-dried.	Actual Weights. Equal in Fresh state.	Actual Weights. Dry Substance (at 212° Fahr.)	Actual Weights. Mineral Matter (Ash).	Per-centages. Dry in Fresh. Each Expert.	Per-centages. Dry in Fresh. Mean.	Per-centages. Ash in Fresh. Each Expert.	Per-centages. Ash in Fresh. Mean.	Per-centages. Ash in Dry. Each Expert.	Per-centages. Ash in Dry. Mean.
Third Crop.*																
			lbs.	lbs.	lbs. ozs.	ozs.	ozs.	ozs.	ozs.	ozs.						
Five-acre	2 (Sewaged)	5	5	25	5 10	50	12·5	55·556	10·090	1·345	18·16	18·24	2·421	2·417	12·330	13·247
							12·5	55·556	10·180	1·340	18·32		2·412		13·163	
	3 (Sewaged)	8	5	40	6 8	50	12·5	76·923	9·918	1·390	12·89	12·89	1·807	1·807	14·015	14·017
							12·5	76·923	9·916	1·390	12·89		1·807		14·018	
	4 (Sewaged)	15	5	75	13 3	50	12·5	71·090	10·094	1·274	14·20	14·19	1·792	1·797	12·621	12·665
							12·5	71·090	10·072	1·280	14·17		1·801		12·708	
Ten-acre	2 (Sewaged)	5	5	25	4 10	50	12·5	67·568	9·810	1·240	14·52	14·52	1·835	1·832	12·640	12·624
							12·5	67·568	9·804	1·236	14·51		1·829		12·607	
	3 (Sewaged)	10	5	60	11 0	50	12·5	68·182	9·800	1·170	14·51	14·44	1·716	1·731	11·830	11·987
		1	10				12·5	68·182	9·800	1·190	14·37		1·745		12·143	
	4 (Sewaged)	9	5	45	3 12	50	12·5	64·286	10·148	1·200	15·78	15·80	1·867	1·908	11·827	12·078
							12·5	64·286	10·164	1·233	15·81		1·949		12·328	
Fourth Crop.																
Ten-acre	4 (Sewaged)	5	5	20	6 8	50	12·5	29·412	9·938	1·294	33·79	33·80	4·307	4·360	12·920	[illegible]
		1	10				12·5	29·412	9·940	1·296	33·80		4·413		13·056	

Third Season, 1863.

Fields.	Plots.	Number of Samples taken.	Weights. In fresh state. Each Sample.	Weights. In fresh state. Total.	Weights. Air-dried Total.	Weights. Air-dried Taken	Actual Weights. Air-dried.	Actual Weights. Equal in fresh state.	Actual Weights. Dry Substance (at 212° Fahr.)	Actual Weights. Mineral Matter (Ash)	Dry in Fresh. Each Expert.	Dry in Fresh. Mean.	Ash in Fresh. Each Expert.	Ash in Fresh. Mean	Ash in Dry. Each Expert.	Ash in Dry. Mean.
	FIRST CROP.															
			lbs	lbs.	lbs. ozs.	ozs.	ozs.	ozs.	ozs.	ozs						
Five-acre	1 (Unsewaged)	6	2½	15	6 1	50	12·5	30·925	11·153	0·820	36·06	36·10	2·652	2·878	7·359	7·072
							12·5	30·925	11·175	0·960	36·14		3·104		8·501	
	2 (Sewaged)	11	5	55	13 8	50	12·5	50·926	10·937	1·006	21·48	21·49	1·975	1·073	9·198	9·187
							12·5	50·926	10·942	1·004	21·49		1·971		9·176	
	3 (Sewaged)	8	5	40	8 1	50	12·5	62·012	10·885	1·100	17·55	17·59	1·774	1·782	10·106	10·129
							12·5	62·012	10·935	1·110	17·63		1·790		10·151	
	4 (Sewaged)	10	5	50	9 5	50	12·5	67·115	10·925	1·100	16·28	16·26	1·639	1·663	10·069	10·218
							12·5	67·115	10·901	1·130	16·24		1·684		10·366	
	0* (Unsewaged)	5	2½	12½	3 2½	50	12·5	49·500	11·205	1·050	22·63	22·75	2·121	2·134	9·371	9·382
							12·5	49·500	11·318	1·063	22·86		2·147		9·392	
	00* (Sewaged)	1	5	5	1 2½	18¾	4·663	19·996	4·090	0·340	20·45	20·49	1·700	1·705	8·313	8·322
							4·663	19·996	4·105	0·342	20·53		1·710		8·331	
Ten-acre	1 (Unsewaged)	12	2½	30	13 4	50	12·5	28·302	11·274	0·807	39·83	39·79	2·851	2·899	7·158	7·286
							12·5	28·302	11·249	0·834	39·75		2·947		7·414	
	2 (Sewaged)	8	5	40	8 7	50	12·5	59·256	10·972	0·909	18·52	18·56	1·534	1·545	8·285	8·325
							12·5	59·256	11·024	0·922	18·60		1·556		8·364	
	3 (Sewaged)	8	5	40	8 2	50	12·5	54·795	10·966	1·096	20·01	20·03	2·000	1·999	9·996	9·983
							12·5	54·795	10·982	1·095	20·04		1·998		9·971	
	4 (Sewaged)	9	5	45	7 9	50	12·5	74·375	10·828	1·144	14·56	14·56	1·538	1·549	10·565	10·639
							12·5	74·375	10·820	1·160	14·56		1·560		10·712	
	0* (Unsewaged)	5	2½	12½	3 6	38	4·75	25·000	4·269	0·370	17·08	17·09	1·480	1·512	8·667	8·850
							4·75	25·000	4·273	0·386	17·09		1·544		9·033	
	0* (Unsewaged)	5	2½	12½	4 14	50	6·25	16·026	5·598	0·484	34·93	34·96	3·033	3·014	8·682	8·621
							6·25	16·026	5·606	0·480	34·98		2·995		8·559	
Rye-grass†	1 (Unsewaged)	6	2½	15	3 12	50	12·5	50·000	10·659	0·976	21·32	21·30	1·952	1·950	9·157	9·157
							12·5	50·000	10·638	0·974	21·28		1·948		9·156	
	0* (Unsewaged)	14	2½	35	8 10	50	12·5	50·725	10·803	0·946	21·30	21·26	1·865	1·860	8·757	8·746
							12·5	50·725	10·763	0·940	21·22		1·853		8·734	

* Unmeasured land; designated Plot 0 when unsewaged, and Plot 00 when sewaged.
† No sewage was applied for the first crop of Plots 2 and 3, and no samples were taken from the Produce.

Table XXIX.—*continued.*

Details of the Sampling, and of the Determinations of Dry Substance and Mineral Matter (Ash), in the Unsewaged and in the Sewaged Meadow Grass and Rye-grass.

Third Season, 1863.

Particulars of Sampling.							Determinations of Dry Substance and Mineral Matter (Ash).									
			Weights.				Actual Weights.				Per-centages.					
Fields.	Plots.	Number of Samples taken.	In Fresh State. Each Sample.	In Fresh State. Total.	Air-dried. Total.	Air-dried. Taken.	Air-dried.	Equal in Fresh State.	Dry Substance (at 212° Fahr).	Mineral Matter (Ash).	Dry in Fresh. Each Expert.	Dry in Fresh. Mean.	Ash in Fresh. Each Expert.	Ash in Fresh. Mean.	Ash in Dry. Each Expert.	Ash in Dry. Mean.
							SECOND CROP.									
			lbs.	*lbs.*	*lbs. ozs.*	*ozs.*	*ozs.*	*ozs.*	*ozs.*	*ozs.*						
Five-acre	1 (Unsewaged)	2 1	2½ 5	10	4 2	50	12·5 12·5	30·303 30·303	10·420 10·437	1·190 1·124	34·39 34·44	34·42	3·027 3·709	3·618	11·420 10·769	11·095
	2 (Sewaged)	6	5	30	6 5	50	12·5 12·5	59·401 59·401	10·093 10·093	1·192 1·180	18·51 18·51	18·51	2·007 1·987	1·997	10·843 10·734	10·789
	3 (Sewaged)	9	5	45	7 12	50	12·5 12·5	72·581 72·581	10·814 10·828	1·130 1·140	14·90 14·92	14·91	1·557 1·571	1·564	10·449 10·528	10·489
	4 (Sewaged)	4	5	20	4 2	50	12·5 12·5	60·606 60·606	10·774 10·800	1·007 0·883	17·78 17·82	17·80	1·662 1·460	1·561	9·347 8·194	8·771
	*0 (Unsewaged)	4 2	2½ 5	20	5 10	50	12·5 12·5	44·444 44·444	10·164 10·183	1·198 1·196	22·87 22·91	22·89	2·696 2·601	2·694	11·787 11·746	11·766
	*00 (Sewaged)	1	10	10	3 7¼	39·75	9·938 9·938	39·998 39·999	8·658 8·629	0·962 0·960	21·65 21·57	21·61	2·406 2·400	2·403	11·111 11·125	11·118
Ten-acre	1 (Unsewaged)	1 1	2½ 5	7½	1 9½	25·5	6·375 6·375	29·095 29·995	5·444 5·454	0·670 0·675	18·15 18·18	18·17	2·234 2·250	2·242	12·307 12·376	12·340
	2 (Sewaged)	6	5	30	6 1	50	12·5 12·5	61·856 61·856	10·932 10·918	1·160 1·220	17·67 17·65	17·66	1·875 1·982	1·929	10·611 11·229	10·920
	3 (Sewaged)	7	5	35	6 8	50	12·5 12·5	67·308 67·308	10·940 10·937	1·230 1·220	16·25 16·25	16·25	1·827 1·813	1·820	11·243 11·155	11·199
	4 (Sewaged)	6	5	30	6 7	49·896†	12·474 12·474	58·127 58·127	10·927 10·951	1·120 1·129	18·80 18·84	18·82	1·927 1·943	1·935	10·250 10·310	10·280
	*0 (Unsewaged)	1 3	2½ 5	17½	5 13	50	12·5 12·5	37·651 37·651	10·009 9·964	1·310 1·000	26·60 26·45	26·53	3·481 2·657	3·069	13·088 10·046	11·567
	*00 (Sewaged)	1	10	10	1 15	31	7·75 7·75	39·090 39·900	6·869 6·851	0·748 0·749	17·17 17·13	17·15	1·865 1·873	1·869	10·862 10·933	10·898
	1 (Unsewaged)	7	2½	17½	4 13	50	12·5 12·5	40·053 40·053	10·990 10·916	0·876 0·895	23·69 23·70	23·70	1·902 1·922	1·912	8·030 8·108	8·069
	[illegible]	9	5	45	9 10	50	12·5 12·5	58·442 58·442	11·004 10·934	0·922 0·920	18·83 18·79	18·81	1·578 1·574	1·576	8·379 8·370	8·375
			*	65	12 15	50	12·5 12·5	62·800 62·800	10·978 11·022	1·044 1·049	17·48 17·55	17·52	1·662 1·670	1·666	9·510 9·517	9·514
							12·5	39·216 [illegible]	10·831 [illegible]	1·950 [illegible]	27·88 [illegible]	27·89	2·677 [illegible]	2·672	9·074 [illegible]	9·088

Table XXIX—*continued.*

Details of the Sampling, and of the Determinations of Dry Substance and Mineral Matter (Ash), in the Unsewaged and in the Sewaged Meadow Grass and Rye-grass.

Third Season, 1863.

Fields.	Plots.	Number of Samples taken.	In fresh state. Each Sample.	In fresh state. Total.	Air-dried. Total.	Air-dried. Taken.	Air-dried.	Equal in fresh State.	Dry Substance (at 212° Fahr.)	Mineral Matter (Ash).	Dry in Fresh. Each Expert.	Dry in Fresh. Mean.	Ash in Fresh. Each Expert.	Ash in Fresh. Mean.	Ash in Dry. Each Expert.	Ash in Dry. Mean.
	Particulars of Sampling.		Weights.				**Determinations of Dry Substance and Mineral Matter (Ash).** Actual Weights.				Percentages.					
								Third Crop.								
			lbs.	lbs.	lbs. ozs.	ozs.	ozs.	ozs.	ozs.	ozs.						
Five-acre	2 (Sewaged)	5	5	25	5 6	50	12·5	58·140	10·273	1·203	17·67	17·67	2·073	2·046	11·730	11·584
							12·5	58·140	10·265	1·174	17·66		2·010		11·437	
	3 (Sewaged)	5	5	25	3 6	50	12·5	92·593	10·139	1·274	10·95	10·92	1·376	1·374	12·565	12·589
							12·5	92·593	10·070	1·270	10·88		1·372		12·613	
	4 (Sewaged)	6	5	30	6 8	50	12·5	57·692	10·143	1·164	17·58	17·58	2·018	2·023	11·477	11·506
							12·5	57·692	10·143	1·170	17·58		2·028		11·535	
Ten-acre	2 (Sewaged)	5	5	25	3 15	50	12·5	79·355	9·850	1·142	12·42	12·42	1·439	1·448	11·597	11·665
							12·5	79·355	9·845	1·156	12·41		1·457		11·742	
	3 (Sewaged)	6	5	30	5 6	50	12·5	69·767	10·140	1·200	14·53	14·58	1·720	1·734	11·834	11·889
							12·5	69·767	10·206	1·219	14·63		1·747		11·944	
	4 (Sewaged)	8	5	40	7 8	50	12·5	66·667	10·115	1·180	15·17	15·17	1·761	1·761	11·666	11·666
							12·5	66·667	10·115	1·180	15·17		1·761		11·666	
	00* (Sewaged)	1	10	10	2 9½	41¼	10·375	39·936	8·430	0·993	21·16	21·12	2·480	2·478	11·727	11·736
							10·375	39·936	8·430	0·990	21·08		2·475		11·744	
Rye-grass	1 (Unsewaged)	8	2½	20	8 14	50	12·5	28·169	10·240	0·705	36·35	36·35	2·503	2·512	6·885	6·910
							12·5	28·169	10·238	0·710	36·34		2·521		6·935	
	2 (Sewaged)	11	5	55	17 6	50	12·5	39·568	10·871	1·091	27·47	27·47	2·757	2·757	10·036	10·036
							12·5	39·568	10·871	1·091	27·47		2·757		10·036	
	3 (Sewaged)	14	5	70	14 4	50	12·5	61·404	11·227	1·190	18·28	18·28	1·938	1·871	10·599	10·235
							12·5	61·404	11·226	1·108	18·28		1·804		9·870	
	0* (Unsewaged)	9	2½	22½	9 14	50	12·5	28·481	10·396	0·840	36·50	36·48	2·949	2·953	8·080	8·095
							12·5	28·481	10·382	0·842	36·45		2·956		8·110	

* Unmeasured land; designated Plot 0 when unsewaged, and Plot 00 when sewaged.

Table XXIX.—*continued.*

Details of the Sampling, and of the Determinations of Dry Substance and Mineral Matter (Ash), in the Unsewaged and in the Sewaged Meadow Grass and Rye-grass.

Third Season, 1863.

Particulars of Sampling.							Determinations of Dry Substance, and Mineral Matter (Ash).									
			Weights.				Actual Weights.				Per-centages.					
			In fresh state.		Air-dried.						Dry in Fresh.		Ash in Fresh.		Ash in Dry.	
Fields.	Plots.	Number of Samples taken.	Each Sample.	Total.	Total.	Taken.	Air-dried.	Equal in Fresh State.	Dry Substance (at 212° Fahr.)	Mineral Matter (Ash).	Each Expert.	Mean.	Each Expert.	Mean.	Each Expert.	Mean.
Fourth Crop.*																
			lbs.	lbs.	lbs. ozs.	ozs.	ozs.	ozs.	ozs.	ozs.						
Five-acre	2 (Sewaged)	2	10	20	3 13	50	12·5	65·505	10·334	1·235	15·76	15·75	1·884	1·876	11·951	11·909
							12·5	65·565	10·323	1·225	15·74		1·868		11·867	
	3 (Sewaged)	4	5	20	3 3	50	12·5	78·419	10·240	1·295	13·06	13·04	1·651	1·693	12·646	12·984
							12·5	78·419	10·209	1·360	13·02		1·734		13·322	
	4 (Sewaged)	8	5	40	6 1	50	12·5	83·467	10·161	1·150	12·32	12·30	1·394	1·447	11·318	11·764
							12·5	82·467	10·131	1·237	12·28		1·500		12·210	
Ten-acre	3 (Sewaged)	3	5	15	2 9	40·805†	10·201	59·701	8·304	1·035	13·91	13·87	1·733	1·738	12·464	12·531
							10·201	59·701	8·255	1·040	13·83		1·742		12·598	
	4 (Sewaged)	6	5	30	3 0	50	12·5	75·000	10·185	1·270	13·58	13·62	1·693	1·697	12·469	12·457
							12·5	75·000	10·245	1·275	13·66		1·700		12·445	
Rye-grass	1 (Unsewaged)	1	2½	7½	3 0	47·815‡	11·954	20·885	9·880	1·130	33·06	33·21	3·781	3·798	11·437	11·435
		1	5				11·954	20·885	9·971	1·140	33·36		3·815		11·433	
	2 (Sewaged)	7	5	35	6 0¼	50	12·5	72·542	10·035	0·990	13·83	13·84	1·365	1·372	9·865	9·912
							12·5	72·542	10·042	1·000	13·84		1·379		9·958	
	3 (Sewaged)	9	5	45	10 7	50	12·5	53·890	10·176	1·120	18·88	18·89	2·089	2·093	11·065	11·083
							12·5	53·890	10·180	1·130	18·89		2·097		11·100	
	0§ (Unsewaged)	4	2½	25	6 12	50	12·5	46·296	10·032	1·396	21·67	21·66	3·015	3·020	13·915	13·942
		3	5				12·5	46·296	10·022	1·400	21·65		3·024		13·969	

* A sample weighing 20 lbs. was also taken from Plot 2 in the ten-acre field, but very late in the season, and it contained so much of fallen leaves (from trees) that the analysis was not proceeded with.

and Rye-grass.

Third Season, 1863.

Particulars of Sampling.							Determinations of Dry Substance and Mineral Matter (Ash).									
			Weights.				Actual Weights.				Per-centages.					
			In fresh state.		Air-dried.						Dry in Fresh.		Ash in Fresh.		Ash in Dry.	
Fields.	Plots.	Number of Samples taken.	Each Sample.	Total.	Total.	Taken.	Air-dried.	Equal in Fresh State.	Dry Substance (at 212° Fahr.)	Mineral Matter (Ash.)	Each Exper[t].	Mean.	Each Exper[t].	Mean.	Each Exper[t].	Mean.
Fifth Crop.*																
			lbs.	lbs.	lbs. ozs.	ozs.	ozs.	ozs.	ozs.	ozs.						
Five-acre	4 (Sewaged)	1	20	20	3 11	†40·845	12·461	67·576	10·308	1·352	15·25	15·25	2·001	1·986	13·116	13·022
							12·461	67·576	10·304	1·332	15·25		1·971		12·927	
Rye-grass	1 (Unsewaged)	1	20	20	4 11	50	12·5	53·328	10·620	1·562	19·91	19·92	2·929	2·937	14·708	14·741
							12·5	53·328	10·627	1·570	19·93		2·944		14·774	
	2 (Sewaged)	2	5	10	2 0¾	32¾	8·063	39·995	6·717	0·874	16·79	16·75	2·185	2·198	13·012	13·121
							8·063	39·995	6·682	0·884	16·71		2·210		13·230	
	3 (Sewaged)	5	5	25	5 6	50	12·5	58·140	10·345	1·270	17·79	17·76	2·184	2·176	12·276	12·254
							12·5	58·140	10·301	1·260	17·72		2·167		12·232	
Sixth Crop.‡																
Rye-grass	2 (Sewaged)	2	10	20	4 6	50	12·5	57·143	10·665	1·496	18·66	18·64	2·618	2·613	14·027	14·014
							12·5	57·143	10·642	1·490	18·62		2·607		14·001	
	3 (Sewaged)	2	10	20	4 13¼	50	12·5	51·610	10·523	1·540	20·39	20·38	2·984	2·941	14·635	14·431
							12 5	51·610	10·508	1·495	20·36		2·897		14·227	

… also taken from Plots 2 and 3 in the 5-acre field, from Plots 3 and 4 in the 10-acre field, and from Plot 0 in the rye-grass field, but very late in the season, and they … (from trees) and some of them were so wet that the analyses were not proceeded with.
… and that weight is, therefore, deducted.
… it contained so much of fallen leaves (from trees) that it was thought better not to proceed with the analysis.

TABLE XXX.

SUMMARY of the Per-centages of Dry Substance (at 212° Fahr.), and of Mineral Matter (Ash), in the Unsewaged and the Sewaged Meadow Grass.

Second Season, 1862.

Plots.	PER-CENTAGES											
	Dry Substance in Fresh Grass.				Mineral Matter in Fresh Grass.				Mineral Matter in Dry Substance.			
	1st Crop.	2d Crop.	3d Crop.	4th Crop.	1st Crop.	2d Crop.	3d Crop.	4th Crop.	1st Crop.	2d Crop.	3d Crop.	4th Crop.
FIVE-ACRE FIELD.												
1 (Unsewaged) . .	26·7*	22·8	..	..	2·41	2·05	..	..	9·02	8·99	..	..
2 (Sewaged) . .	22·8	14·3	18·3	..	1·92	1·72	2·48	..	8·44	12·09	13·25	..
3 (Sewaged) . .	14·4	16·4	12·9	..	1·39	1·70	1·31	..	9·65	10·38	14·08	..
4 (Sewaged) . .	15·8	19·4	14·2	..	1·48	2·08	1·80	..	9·38	10·39	12·67	..
TEN-ACRE FIELD.												
1 (Unsewaged) . .	26·9	17·9	..	..	2·52	2·09	..	..	9·38	11·68	..	..
2 (Sewaged) . .	19·5	16·2	14·5	..	1·84	1·66	1·83	..	9·40	11·61	12·63	..
3 (Sewaged) . .	15·5	19·0	14·4	..	1·54	1·92	1·73	..	11·37	10·12	11·99	..
4 (Sewaged) . .	13·1	16·7	15·8	33·8	1·63	1·60	1·91	4·39	12·44	10·07	12·08	12·99

TABLE XXXI.

SUMMARY of the Per-centages of Dry Substance (at 212° Fahr.), and of Mineral Matter (Ash), in the Unsewaged and the Sewaged Meadow Grass and Rye-grass.

Third Season, 1863.

Plots.	PER-CENTAGES.																	
	Dry Substance in Fresh Grass.						Mineral Matter in Fresh Grass.						Mineral Matter in Dry Substance.					
	1st Crop.	2d Crop.	3d Crop.	4th Crop.	5th Crop.	6th Crop.	1st Crop.	2d Crop.	3d Crop.	4th Crop.	5th Crop.	6th Crop.	1st Crop.	2d Crop.	3d Crop.	4th Crop.	5th Crop.	6th Crop.
FIVE-ACRE FIELD.																		
1 (Unsewaged) - -	36·1	34·4	..	..	..	..	2·88	3·82	..	..	..	..	7·97	11·10	..	..	..	..
2 (Sewaged) - -	21·5	18·5	17·7	15·8	..	..	1·97	2·00	2·05	1·88	..	..	9·19	10·79	11·58	11·91	..	..
3 (Sewaged) - -	17·6	14·9	10·9	13·0	..	..	1·78	1·56	1·37	1·69	..	..	10·13	10·49	12·59	12·98	..	..
4 (Sewaged) - -	16·3	17·8	17·6	12·3	15·3	..	1·66	1·56	2·02	1·45	1·99	..	10·22	8·77	11·51	11·76	13·02	..
TEN-ACRE FIELD.																		
1 (Unsewaged) - -	39·8	18·2	..	..	..	..	2·00	2·21	..	..	..	..	7·29	12·34	..	..	..	..
2 (Sewaged) - -	18·6	17·7	12·4	..	..	..	1·55	1·93	1·45	..	..	..	8·33	10·92	11·67	..	..	..
3 (Sewaged) - -	20·0	16·3	14·6	13·9	..	..	2·00	1·82	1·73	1·74	..	..	9·98	11·20	11·89	12·53	..	..
4 (Sewaged) - -	14·6	18·8	15·2	13·6	..	..	1·55	1·94	1·76	1·70	..	..	10·64	10·28	11·67	12·46	..	..
RYE-GRASS.																		
1 (Unsewaged) - -	21·3	23·7	36·4	33·2	19·9	..	1·95	1·91	2·51	3·80	2·94	..	9·16	8·07	6·91	11·44	14·74	..
2 (Sewaged) - -	*	18·8	27·5	13·8	16·8	18·6	*	1·58	2·76	1·37	2·20	2·61	*	8·38	10·04	9·91	13·12	14·01
3 (Sewaged) - -	*	17·5	18·3	18·9	17·8	20·4	*	1·67	1·87	2·09	2·18	2·94	*	9·51	10·24	11·08	12·25	14·43

* No Sewage was applied for the 1st Crop of Plots 2 and 3, and no Samples were taken from the produce.

TABLE XXXII.

SHOWING the Composition (per cent.) of the Unsewaged and the Sewaged Meadow Grass in the *Fresh State*, as weighed.

Second Season, 1862.

—	First Crop.						Second Crop.					Third Crop.			Fourth Crop.
	Unsewaged.			Sewaged.			Unsewaged.		Sewaged.			Sewaged.			Sewaged.
	Plot 0*. (1.)	Plot 0*. (2.)	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 0*.	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 2.	Plot 3.	Plot 4.	Plot 4.
FIVE-ACRE FIELD.															
Nitrogenous substance (N×6·3)	2·18	1·33	2·39	1·79	1·54	2·31	2·80	1·50	2·48	2·35	2·71	4·35	2·30	2·06	—
Fatty matter (ether extract)	0·56	0·61	0·71	0·54	0·38	0·47	0·83	0·61	0·57	0·67	0·73	0·84	0·51	0·61	—
Woody fibre	6·70	7·68	8·33	7·44	4·60	4·75	6·22	7·05	4·25	4·80	5·68	4·76	3·53	3·80	—
Other non-nitrogenous substances	10·37	11·68	12·66	11·06	6·48	6·42	8·68	11·46	5·31	6·89	8·32	5·92	4·26	5·11	—
Mineral matter (ash)	1·83	2·33	2·58	1·90	1·32	1·33	2·47	2·07	1·70	1·71	1·95	2·37	1·79	1·71	—
Total dry substance	21·64	23·62	26·67	22·75	14·41	15·28	21·06	22·75	14·31	16·42	19·30	18·24	12·89	14·10	—
Water	78·36	76·36	73·33	77·25	85·59	84·72	78·94	77·25	85·69	83·58	80·61	81·76	87·11	85·61	—
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·[illegible]	—
TEN-ACRE FIELD.															
Nitrogenous substance (N×6·3)	0·97		2·61	2·18	2·30	2·87	—	2·23	2·17	2·10	1·80	2·93	2·74	2·69	6·16
Fatty matter (other extract)	0·24		0·70	0·54	0·42	0·54	—	0·68	0·71	0·66	0·57	0·68	0·68	0·61	1·49
Woody fibre	2·97		8·28	0·44	4·10	5·21	—	4·67	4·47	5·41	5·03	3·79	3·85	4·39	8·40
Other non-nitrogenous substances	4·55		12·73	9·01	5·30	3·56	—	8·22	6·08	8·77	7·67	5·31	5·41	6·39	13·08
Mineral matter (ash)	0·61		2·48	1·35	1·33	0·95	—	2·10	1·82	1·93	1·66	1·81	1·78	1·81	4·67

TABLE XXXIII.

SHOWING the Composition (per cent.) of the Dry Substance of the Unsewaged and the Sewaged Meadow Grass.

Second Season, 1862.

—	First Crop.						Second Crop.					Third Crop.			Fourth Crop.
	Unsewaged.			Sewaged.			Unsewaged.		Sewaged.			Sewaged.			Sewaged.
	Plot 0.*		Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 0.*	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 2.	Plot 3.	Plot 4.	Plot 4.
	(1.)	(2.)													
FIVE-ACRE FIELD.															
Nitrogenous substance (N × 6·3)	10·09	5·59	8·95	7·87	10·66	15·11	13·59	6·86	17·33	14·28	13·96	23·87	21·71	20·89	—
Fatty matter (ether extract)	2·60	2·59	2·68	2·38	2·63	3·10	3·91	2·66	4·00	4·05	3·79	4·62	3·98	4·29	—
Woody fibre	30·97	32·53	31·25	32·68	32·53	31·11	29·54	30·99	29·69	29·36	29·31	26·10	27·37	26·80	—
Other non-nitrogenous substances	47·90	49·45	47·46	48·71	45·00	42·01	41·23	50·38	37·12	41·98	42·90	32·44	33·07	36·00	—
Mineral matter (ash)	8·44	9·84	9·66	8·36	9·18	8·67	11·73	9·11	11·36	10·43	10·04	12·97	13·87	12·02	—
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	—
TEN-ACRE FIELD.															
Nitrogenous substance (N × 6·3)	10·16		9·71	11·17	17·01	21·84	—	12·44	13·46	11·55	10·79	20·19	18·98	17·01	18·22
Fatty matter (ether extract)	2·48		2·61	2·77	3·07	4·10	—	3·78	4·38	3·50	3·41	4·70	4·58	3·86	4·42
Woody fibre	31·13		30·84	33·00	30·81	39·70	—	26·10	27·67	28·52	30·05	26·09	26·62	27·19	24·86
Other non-nitrogenous substances	47·73		47·63	46·16	39·24	27·15	—	45·91	43·22	46·25	45·84	36·55	37·48	40·45	38·70
Mineral matter (ash)	8·50		9·21	6·90	9·87	7·21	—	11·77	11·27	10·18	9·91	12·47	12·34	11·49	13·80
	100·00		100·00	100·00	100·00	100·00	—	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

* Designated Plot 0 when unmeasured land.

TABLE XXXIV.

SHOWING the Composition (per cent.) of the Unsewaged and the Sewaged Meadow Grass in the *Fresh State*, as weighed.

Third Season, 1863.

—	First Crop.				Second Crop.				Third Crop.			Fourth Crop.			Fifth Crop.
	Unsewaged.	Sewaged.			Unsewaged.	Sewaged.			Sewaged.			Sewaged.			Sewaged.
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 2.	Plot 3.	Plot 4.	Plot 2.	Plot 3.	Plot 4.	Plot 4.
FIVE-ACRE FIELD.															
Nitrogenous substance (N × 6·3)	3·75	2·93	3·65	3·95	4·44	3·07	3·04	3·15	3·30	2·46	3·89	4·03	3·30	3·15	4·91
Fatty matter (ether extract)	1·14	1·09	0·96	0·86	1·46	0·98	0·56	0·70	0·95	0·58	0·88	0·59	0·60	0·61	0·77
Woody fibre	10·92	5·38	4·10	3·60	8·67	5·21	4·32	5·37	4·41	2·80	4·38	3·41	3·15	3·00	3·18
Other non-nitrogenous substances	18·65	10·11	7·73	6·67	15·74	7·01	5·41	6·59	6·95	3·09	6·42	5·27	4·31	3·97	4·53
Mineral matter (ash)	2·64	1·96	1·77	1·78	3·69	2·18	1·58	1·79	2·06	1·39	2·08	1·85	1·50	1·37	1·96
Total dry substance	36·10	21·40	17·59	16·26	34·42	18·51	14·91	17·80	17·67	10·92	17·58	15·75	13·04	12·30	15·25
Water	63·90	78·51	82·41	83·74	65·58	81·49	85·09	82·20	82·33	89·08	82·42	84·25	86·96	87·70	84·75
	100·[illegible]	100·[illegible]	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
TEN-ACRE FIELD.															
Nitrogenous substance (N × 6·3)	3·60	3·40	3·19	2·87	2·17	3·31	3·15	2·92	2·38	2·54	3·02	—	3·54	3·38	—
Fatty matter (ether extract)	1·72	0·94	0·67	0·85	0·82	0·96	0·62	0·65	0·68	0·65	0·70	—	0·70	0·75	—
Woody fibre	12·97	5·52	5·17	3·43	4·72	4·72	4·47	5·66	3·24	3·90	4·26	—	3·17	3·21	—
Other non-nitrogenous substances	18·65	8·13	8·81	5·81	8·16	6·60	6·12	7·63	4·60	5·79	5·38	—	4·75	4·55	—
Mineral matter (ash)	2·85	1·57	1·99	1·02	2·30	2·11	1·89	1·98	1·60	1·70	1·81	—	1·71	1·73	—
Total dry substance	39·79	18·56	20·03	14·56	18·17	17·66	16·25	18·82	12·42	14·58	15·17	—	13·87	13·62	—
Water	60·21	81·44	79·97	85·44	81·83	82·34	83·75	81·18	87·58	85·42	84·83	—	86·13	86·38	—
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	—	100·00	100·00	—

Table XXXV.

Showing the Composition (per cent.) of the *Dry Substance of the Unsewaged* and the Sewaged Meadow Grass.

Third Season, *1863.*

—	First Crop.				Second Crop.				Third Crop.			Fourth Crop.			Fifth Crop.
	Unsewaged.	Sewaged.			Unsewaged.	Sewaged.			Sewaged.			Sewaged.			Sewaged.
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Plot 2.	Plot 3.	Plot 4.	Plot 2.	Plot 3.	Plot 4.	Plot 4.
Five-acre Field.															
Nitrogenous substance (N × 6·3)	7·62	13·71	17·33	24·31	12·88	16·57	20·38	17·71	18·66	22·60	21·71	29·39	25·27	25·59	32·19
Fatty matter (ether extract)	3·16	5·09	5·40	5·27	4·31	5·29	3·75	3·91	5·38	5·30	4·98	3·77	5·33	4·96	5·07
Woody fibre	30·24	25·02	23·34	22·13	25·78	28·31	28·94	31·32	24·97	25·62	24·94	21·65	24·15	24·42	20·51
Other non-nitrogenous substances	51·66	47·06	43·88	37·35	45·73	38·07	36·31	37·02	39·33	33·76	36·51	33·43	33·02	32·24	29·62
Mineral matter (ash)	7·32	9·12	10·05	10·94	11·30	11·76	10·62	10·04	11·66	12·72	11·86	11·76	12·23	12·79	12·61
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Ten-acre Field.															
Nitrogenous substance (N × 6·3)	8·81	12·95	15·94	19·75	11·94	18·73	19·42	15·49	18·98	17·46	19·87	—	25·53	24·82	—
Fatty matter (ether extract)	4·32	5·04	4·33	5·69	4·52	5·46	3·79	3·46	5·28	4·46	4·62	—	5·07	5·53	—
Woody fibre	32·59	29·74	25·83	23·54	25·95	26·72	27·50	30·08	26·12	26·76	28·07	—	22·83	23·59	—
Other non-nitrogenous substances	46·87	43·81	43·97	39·92	44·91	37·17	37·66	40·54	37·53	39·68	35·49	—	34·25	33·38	—
Mineral matter (ash)	7·41	8·46	9·93	11·10	12·68	11·92	11·63	10·43	12·09	11·64	11·95	—	12·32	12·68	—
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	—	100·00	100·00	—

TABLE XXXVI.

SHOWING the Composition (per cent.) of the Unsewaged and the Sewaged Italian Rye-grass in the *Fresh State*, as weighed.

Season 1863.

—	First Crop.	Second Crop.			Third Crop.			Fourth Crop.			Fifth Crop.			Sixth Crop.	
	Un-sewaged.	Un-sewaged.	Sewaged.		Un-sewaged.	Sewaged.		Un-sewaged.	Sewaged.		Un-sewaged.	Sewaged.		Sewaged.	
	Plot 1.	Plot 1.	Plot 2.	Plot 3.	Plot 1.	Plot 2.	Plot 3.	Plot 1.	Plot 2.	Plot 3.	Plot 1.	Plot 2.	Plot 3.	Plot 2.	Plot 3.
Nitrogenous substance (N × 6·3) -	2·67	1·94	3·26	2·29	3·05	3·33	2·38	4·95	2·30	3·50	3·63	3·87	3·80	4·60	5·06
Fatty matter (ether extract) -	0·77	0·73	0·72	0·37	1·10	0·80	0·59	1·18	0·77	0·73	0·87	0·81	0·75	0·83	1·19
Woody fibre - - -	3·79	5·84	4·40	4·93	10·36	7·70	5·45	8·33	3·88	5·36	4·61	4·20	3·50	4·22	4·42
Other non-nitrogenous substances	12 05	13·28	6·49	8·39	19·24	12·77	8·61	14·97	5·48	7·17	7·87	5·63	7·45	6·33	6·62
Mineral matter (ash) - -	2·02	1·91	1·85	1·54	2·36	2·08	1·31	3·78	1·41	2·13	2·94	2·25	2·26	2·66	3·09
Total dry substance - -	21·30	23·70	18·81	17·52	36·35	27·47	18·28	33·21	13·84	18·89	19·92	16·75	17·76	18·64	20·38
Water - - - -	78·70	76·30	81·19	82·48	63·65	72·53	81·72	66 79	86·16	81·11	80·08	83·25	82 24	81·36	79·62
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

TABLE XXXVII.

SHOWING the Composition (per cent.) of the *Dry Substance* of the Unsewaged and the Sewaged Italian Rye-grass.

Season 1863.

—	First Crop.	Second Crop.			Third Crop.			Fourth Crop.			Fifth Crop.			Sixth Crop.	
	Un-sewaged.	Un-sewaged.	Sewaged.		Un-sewaged.	Sewaged.		Un-sewaged.	Sewaged.		Un-sewaged.	Sewaged.		Sewaged.	
	Plot 1.	Plot 1.	Plot 2.	Plot 3.	Plot 1.	Plot 2.	Plot 3.	Plot 1.	Plot 2.	Plot 3.	Plot 1	Plot 2.	Plot 3.	Plot 2.	Plot 3.
Nitrogenous substance (N × 6·3) -	12·51	8·19	17·33	13·07	8·38	12·12	12·70	14·92	16·63	18·54	18·22	23·11	21·40	24·70	24·88

TABLE XXXVIII.

AVERAGE Composition (per cent.) of the Meadow Grass from each Plot, and of each successive Crop. Second Season, 1862.

—	Mean Composition, per Cent.															
	Of the Fresh Grass as weighed.								Of the Dry Substance of the Grass.							
	Without, or with different Quantities of Sewage.				In each successive Crop.				Without, or with different Quantities of Sewage.				In each successive Crop.			
	Un-sewaged.	Sewaged.							Un-sewaged.	Sewaged.						
	Plot 1.	Plot 2.	Plot 3.	Plot 4.	1st Crop.	2d Crop.	3d Crop.	4th Crop.	Plot 1.	Plot 2.	Plot 3.	Plot 4.	1st Crop.	2d Crop.	3d Crop.	4th Crop.
Five-acre Field.																
Number of analyses	2	3	3	3	4	4	3	—	2	3	3	3	4	4	3	—
Nitrogenous substance (N × 6·3)	1·97	2·87	2·23	2·66	2·01	2·28	3·37	—	7·91	16·36	15·55	16·65	10·65	13·11	22·16	—
Fatty matter (ether extract)	0·66	0·65	0·52	0·60	0·53	0·64	0·65	—	2·67	3·67	3·55	3·73	2·70	3·62	4·29	—
Woody fibre	7·69	5·48	4·34	4·75	6·30	5·44	4·03	—	31·12	29·49	29·72	29·07	31·89	29·81	26·76	—
Other non-nitrogenous substances	12·06	7·44	5·88	6·62	9·16	8·00	5·10	—	48·92	39·42	40·02	40·31	45·79	43·10	33·84	—
Mineral matter (ash)	2·33	1·99	1·60	1·66	1·78	1·86	1·96	—	9·38	11·06	11·16	10·24	8·97	10·36	12·95	—
Total dry substance	24·71	18·43	14·57	16·29	19·78	18·22	15·11	—								
Water	75·29	81·57	85·43	83·71	80·22	81·78	84·89	—								
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	—	100·00	100·00	100·00	100·00	100·00	100·00	100·00	—
Ten-acre Field.																
Number of analyses	2	3	3	4	4	4	3	1	2	3	3	4	4	4	3	1
Nitrogenous substance (N × 6·3)	2·42	2·43	2·41	3·38	2·49	2·10	2·79	6·16	11·08	14·94	15·85	16·97	14·93	12·06	18·73	18·22
Fatty matter (ether extract)	0·69	0·64	0·58	0·80	0·55	0·65	0·65	1·49	3·19	3·95	3·72	3·95	3·14	3·77	4·38	4·42
Woody fibre	6·47	4·90	4·47	5·74	6·02	4·90	3·98	8·40	28·47	28·92	28·65	30·45	33·59	28·09	26·63	24·86
Other non-nitrogenous substances	10·51	7·10	6·49	7·68	7·67	7·91	5·70	13·08	46·77	41·98	40·99	38·03	40·04	45·30	38·16	38·70
Mineral matter (ash)	2·29	1·66	1·68	2·27	1·53	1·88	1·80	4·67	10·49	10·21	10·70	10·60	8·30	10·78	12·10	13·80
Total dry substance	22·38	16·73	15·63	19·87	18·26	17·44	14·92	33·80								
Water	77·62	83·27	84·37	80·13	81·74	82·56	85·08	66·20								
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Table XXXIX.

Average Composition (per [illegible]) of the Meadow Grass from each Plot, and of each successive Crop.

Third Season, 1863.

Mean Composition, per Cent.

Of the Fresh Grass as weighed.

—	Without, or with different Quantities of Sewage. Un-sewaged. Plot 1.	Sewaged. Plot 2.	Sewaged. Plot 3.	Sewaged. Plot 4.	In each successive Crop. 1st Crop.	2d Crop.	3d Crop.	4th Crop.	5th Crop.
Five-acre Field.									
Number of analyses	2	4	4	5	4	4	3	3	1
Nitrogenous substance (N×6·3)	3·60	3·49	2·06	3·80	3·17	3·42	3·19	3·09	4·01
Fatty matter (ether extract)	1·31	0·90	0·70	0·76	1·01	0·93	0·80	0·63	0·77
Woody fibre	9·80	4·01	3·39	3·04	6·00	6·00	3·86	3·19	3·13
Other non-nitrogenous substances	17·20	7·34	5·28	5·51	10·64	8·70	5·09	4·52	4·52
Mineral matter (ash)	3·26	2·01	1·55	1·33	2·04	2·30	1·85	1·67	1·92
Total dry substance	35·26	18·35	14·11	15·84	22·86	21·41	16·39	13·70	15·25
Water	64·74	81·65	85·89	84·16	77·14	78·59	84·61	86·30	84·75
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Ten-acre Field.									
Number of analyses	2	3	4	4	4	4	3	2	—
Nitrogenous substance (N 6×3)	2·63	2·69	3·10	3·05	2·99	2·80	2·64	3·46	—
Fatty matter (ether extract)	1·27	0·85	0·71	0·73	1·00	0·76	0·67	0·73	—
Woody fibre	6·64	4·49	4·18	4·14	6·77	4·89	3·60	3·19	—
Other non-nitrogenous substances	13·41	8·45	6·37	5·84	10·35	7·12	5·23	4·65	—
Mineral matter (ash)	2·03	1·73	1·82	1·78	2·03	2·07	1·07	1·72	—
Total dry substance	25·98	16·21	16·18	15·54	23·23	17·73	14·06	13·75	—
Water	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	82·27	85·94	86·25	—

Of the Dry Substance of the Grass.

—	Without, or with different Quantities of Sewage. Un-sewaged. Plot 1.	Sewaged. Plot 2.	Sewaged. Plot 3.	Sewaged. Plot 4.	In each successive Crop. 1st Crop.	2d Crop.	3d Crop.	4th Crop.	5th Crop.
Five-acre Field.									
Number of analyses	2	4	4	5	4	[illegible]	3	3	1
Nitrogenous substance (N×6·3)	10·25	19·58	21·40	24·30	16·74	16·69	20·09	26·76	32·19
Fatty matter (ether extract)	3·73	4·88	4·84	4·84	4·73	4·31	5·22	4·68	5·07
Woody fibre	29·01	24·09	25·51	24·66	25·18	28·59	25·13	23·41	20·51
Other non-nitrogenous substances	43·70	39·47	36·74	34·55	41·99	30·98	36·63	32·90	29·62
Mineral matter (ash)	9·31	11·08	11·41	11·65	9·36	10·93	12·96	12·26	12·61
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Ten-acre Field.									
Number of analyses	2	3	4	4	[illegible]	4	3	2	—
Nitrogenous substance (N 6×3)	10·33	16·69	19·59	19·98	14·36	16·39	16·77	25·17	—
Fatty matter (ether extract)	4·43	5·28	4·41	4·63	4·84	4·31	4·79	5·30	—
Woody fibre	20·27	27·63	25·73	26·32	27·93	27·56	28·98	23·21	—
Other non-nitrogenous substances	45·60	30·50	38·59	37·33	43·64	40·07	37·57	33·62	—
Mineral matter (ash)	10·04	10·62	11·39	11·54	9·23	11·07	11·69	12·50	—

Table XL.

Average Composition (per cent.) of the Italian Rye-grass from each Plot, and of each successive Crop.

Season 1863.

—	Mean Composition, per Cent.																	
	Of the Fresh Grass, as weighed.									Of the Dry Substance of the Grass.								
	Without, or with different Quantities of Sewage.			In each successive Crop.						Without, or with different Quantities of Sewage.			In each successive Crop.					
	Un-sewaged.	Sewaged.								Un-sewaged.	Sewaged.							
	Plot 1.	Plot 2.	Plot 3.	1st Crop.	2d Crop.	3d Crop.	4th Crop.	5th Crop.	6th Crop.	Plot 1.	Plot 2.	Plot 3.	1st Crop.	2d Crop.	3d Crop.	4th Crop.	5th Crop.	6th Crop.
Number of Analyses	5	5	5	1	3	3	3	3	2	5	5	5	1	3	3	3	3	2
Nitrogenous substance (N × 6·3)	3·25	3·47	3·39	2·67	2·49	2·90	3·58	3·77	4·83	12·44	18·78	18·11	12·51	12·86	11·07	16·70	20·91	24·76
Fatty matter (ether extract)	0·93	0·82	0·73	0·77	0·61	0·89	0·89	0·81	1·01	3·53	4·45	3·85	3·61	3·01	3·28	4·31	4·49	5·13
Woody fibre	6·79	4·90	4·73	3·79	5·42	7·84	5·86	4·10	4·32	24·68	25·51	25·55	17·79	26·95	28·79	27·16	22·64	22·16
Other non-nitrogenous substances	13·29	7·74	7·65	12·05	9·72	13·55	9·21	6·98	6·47	49·21	39·76	41·47	56·59	48·28	48·88	40·87	38·34	33·24
Mineral matter (ash)	2·64	2·17	2·07	2·02	1·77	2·19	2·44	2·48	2·88	10·14	11·50	11·02	9·50	8·90	7·98	10·96	13·62	14·71
Total dry substance	26·90	19·10	18·57	21·30	20·01	27·37	21·98	18·14	19·51									
Water	73·10	80·90	81·43	78·70	79·99	72·63	78·02	81·86	80·49									
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Table XLI.

Showing the Composition (per cent.) of the Milk from Cows fed respectively Unsewaged and Sewaged Meadow Grass, with Oilcake in addition.

Season 1862.

—	Food—Grass and Oilcake.						
	Dates of Collection.						Mc
	May 10.	June 4.	July 2.	Aug. 6.	Sept. 4.	Oct. 1.	
From 8 Cows on Unsewaged Grass.							
Casein	3·571	3·209	3·511	3·379	3·682	3·725	3
Butter	4·085	3·991	3·561	4·132	3·356	3·880	3
Sugar of milk, &c.	3·969	4·949	4·657	4·331	4·423	4·684	4
Mineral matter	0·744	0·713	0·778	0·798	0·757	0·728	0
Total solid matter	12·369	12·862	12·507	12·640	12·218	13·017	12
Water	87·631	87·138	87·493	87·360	87·782	86·983	87
	100·000	100·000	100·000	100·000	100·000	100·000	100
From 12 Cows on Sewaged Grass.							
Casein	3·554	3·324	3·434	3·189	3·651	3·649	3
Butter	3·750	3·672	3·459	3·281	3·310	3·879	3
Sugar of milk, &c.	3·951	4·560	4·658	4·677	4·329	4·463	4
Mineral matter	0·761	0·712	0·769	0·763	0·839	0·785	0
Total solid matter	12·016	12·268	12·320	11·910	12·129	12·776	12·
Water	87·984	87·732	87·680	88·090	87·871	87·224	87·
	100·000	100·000	100·000	100·000	100·000	100·000	100·

TABLE XLII.

Details of the Sampling, and of the Determinations of Dry Substance, and Mineral Matter (Ash), in the Grass grown in the Fourth Season, 1864, without Sewage.

Particulars of Sampling.								Determinations of Dry Substance, and Mineral Matter (Ash).									
				Weights.				Actual Weights.				Per-centages.					
				In fresh state.		Air-dried.						Dry in Fresh.		Ash in Fresh.		Ash in Dry.	
Fields.	Plots.	How treated in 1861, 1862, and 1863.	Number of Samples taken.	Each Sample.	Total.	Total.	Taken.	Air-dried.	Equal in Fresh State.	Dry Substance (at 212° Fahr.)	Mineral Matter. (Ash.)	Each Expert.	Mean.	Each Expert.	Mean.	Each Expert.	Mean.
First Crop.																	
				lbs.	*lbs.*	*lbs. ozs.*	*ozs.*	*ozs.*	*ozs.*	*ozs.*	*ozs.*						
Five-acre	1	Unsewaged	2	10	20	8 6	50	12·5	29·851	10·392	0·764	34·81	34·70	2·559	2·569	7 352	7·406
								12·5	29·851	10·323	0·770	34·58		2·579		7·459	
	2	Sewaged	4	5	20	7 5	50	12·5	34·188	10·330	0·790	30·22	30·19	2·311	2·325	7·648	7·703
								12·5	34·188	10·312	0 800	30·16		2·339		7·758	
	3	Sewaged	4	5	20	6 14	50	12·5	36·364	10·250	0·770	28·19	28·12	2·117	2·131	7·512	7·580
								12·5	36·364	10·199	0·780	28·05		2·145		7·648	
	4	Sewaged	4	5	20	5 0	50	12·5	50·000	10·155	0·900	20·31	20·33	1·800	1·810	8·863	8·904
								12·5	50·000	10·173	0·910	20·35		1·820		8·945	
Ten-acre	1	Unsewaged	2	10	20	8 1	50	12·5	31·008	10·348	0·714	33·37	33·36	2·303	2·274	6·900	6·815
								12·5	31·008	10·344	0·696	33·36		2·245		6·729	
	2	Sewaged	1	10	20	7 8	50	12·5	33·333	10·252	0·790	30·76	30 84	2·370	2·376	7·706	7·705
			2	5				12·5	33·333	10·306	0·794	30·92		2·382		7·704	
	3	Sewaged	4	5	20	5 12	50	12·5	43·478	10·312	0·834	23·72	23·63	1·918	1·907	8·088	8·072
								12·5	43·478	10·230	0·824	23·53		1·895		8·055	
	4	Sewaged	4	5	20	5 5	50	12·5	47·059	10·110	0·893	21·48	21·50	1·898	1·905	8·833	8·862
								12·5	47·059	10·124	0·900	21·51		1·912		8·890	
Second Crop.																	
Five-acre	4	Sewaged	1	20	20	13 7	50	12·5	18·605	10·337	0·803	55·56	55·53	4·316	4·292	7·768	7·730
								12·5	18·605	10·323	0·794	55·49		4·268		7·692	

Table XLIII.

Results of the Mechanical Analysis of the Rugby Soils.

Composition per Cent.

——	Plot 1.	Plot 2.	Plot 3.	Plot 4.	Mean.
Five-acre Field.					
Stones retained by 1 inch sieve -	5·59	6·95	7·49	6·01	6·51
Stones passing 1 inch, and retained by ½ inch sieve - -	9·48	7·33	7·43	6·18	7·60
Stones passing ½ inch, and retained by ¼ inch sieve - -	6·04	4·44	3·58	3·36	4·35
Total stones -	21·11	18·72	18·50	15·55	18·46
Mould passing ¼ inch sieve -	77·77	80·36	79·80	83·29	80·31
Roots, loss by evaporation, &c. -	1·12	0·92	1·70	1·16	1·23
Total fresh mould -	78·89	81·28	81·50	84·45	81·54
	100·00	100·00	100·00	100·00	100·00
Ten-acre Field.					
Stones retained by 1 inch sieve -	1·54	2·47	3·66	2·90	2·64
Stones passing 1 inch, and retained by ½ inch sieve - -	1·92	2·18	2·43	3·68	2·55
Stones passing ½ inch, and retained by ¼ inch sieve - -	3·04	1·72	1·98	3·43	2·54
Total stones -	6·50	6·37	8·07	10·01	7·73
Mould passing ¼ inch sieve -	92·65	91·25	90·36	89·13	90·85
Roots, loss by evaporation, &c. -	0·85	2·38	1·57	0·86	1·42
Total fresh mould -	93·50	93·63	91·93	89·99	92·27
	100·00	100·00	100·00	100·00	100·00

The mode of collecting the samples was as follows:—A strong iron frame, in the form of the four sides of a box without either top or bottom, 12 inches square by 9 inches deep, was driven into the ground as much more than 9 inches as to allow a very thin sod (only just thick enough to insure the removal of the whole of the green matter) to be taken off the top of it. The contents of the frame were then carefully dug out; and four such samples of 12 inches square by 9 inches deep were taken from each plot, and mixed together. The soil of each plot was thus represented by a sample, averaging, in the case of the Five-acre Field rather over, and in that of the Ten-acre Field somewhat under, 300 lbs.

Table XLIV.

Results of the Chemical Analysis of the Rugby Soils.

Per-centages of Water, Organic Matter, Nitrogen, and Nitrogen reckoned as Ammonia.

Plots.	Water per Cent.		Organic Matter per Cent.			Nitrogen* per Cent.							Nitrogen reckoned as Ammonia. Mean, per Cent.		
	In Fresh Mould as analysed.	In Total Fresh Soil (including Stones, &c.)	In Fresh Mould.	In Dry Mould.	In Total Fresh Soil (including Stones, &c.)	In Fresh Mould.					In Dry Mould.	In Total Fresh Soil (including Stones, &c.)	In Fresh Mould.	In Dry Mould.	In Total Fresh Soil (including Stones, &c.)
						Exp^t. 1.	Exp^t. 2.	Exp^t. 3.	Exp^t. 4.	Mean.	Mean.	Mean.			
Five-acre Field.															
1	14·65	11·39	5·30	6·21	4·12	0·192	0·191	0·191	0·191	0·191	0·224	0·148	0·232	0·272	0·180
2	15·59	12·53	5·80	6·87	4·66	0·195	0·191	0·197	0·204	0·197	0·233	0·158	0·239	0·283	0·192
3	15·22	12·15	6·06	7·15	4·84	0·187	0·183	0·190	0·182	0·185	0·218	0·148	0·225	0·265	0·180
4	14·63	12·23	5·05	5·92	4·21	0·182	0·181	0·186	0·184	0·183	0·214	0·152	0·222	0·260	0·185
Mean -	15·04	12·08	5·55	6·54	4·46	0·189	0·187	0·191	0·190	0·189	0·222	0·152	0·230	0·270	0·184
Ten-acre Field.															
1	20·66	19·14	9·10	11·47	8·43	0·264	0·258	0·257	0·252	0·258	0·325	0·239	0·313	0·395	0·290
2	18·61	16·98	9·80	12·04	8·94	0·243	0·247	0·236	0·246	0·243	0·299	0·222	0·295	0·363	0·270
3	17·60	15·90	8·20	9·95	7·41	0·240	0·236	0·226	0·231	0·233	0·283	0·211	0·283	0·344	0·256
4	17·56	15·65	9·20	11·16	8·20	0·254	0·247	0·252	0·249	0·251	0·304	0·224	0·305	0·369	0·272
Mean -	18·61	16·92	9·08	11·16	8·25	0·250	0·247	0·243	0·245	0·246	0·303	0·224	0·299	0·368	0·272

* The Nitrogen was determined by combustion with soda lime, and estimation as ammonia in the usual volumetric way. The results do not, therefore, represent the total nitrogen inclusive of that in the form of nitric acid, if any, excepting so far as it might be reduced by the organic matter present. Further, as the note at the foot of Table XLIII. will show, the figures only relate to the composition of the layer of 9 inches in thickness taken immediately below a very thin sod.

APPENDIX No. 2.

Notes on the Edinburgh Sewage Meadows.

The following statements relating to the sewage-irrigated meadows in the neighbourhood of Edinburgh are based partly upon information obtained on the spot from Mr. Mc Pherson the city surveyor, and from the occupiers or managers of the meadows in the respective localities, and partly upon correspondence with the latter gentlemen. Mr. Mc Pherson kindly provided information as to the population, water supply, springs, and area of rainfall and drainage, contributing to each set of meadows as named or classed together in Table I. below; and from the occupiers or managers, information as to the area under irrigation, and other points, was obtained. As, however, the sewage is in no case passed over the land the whole 365 days and nights of the year, it must be borne in mind that the statements given as to the amount of population contributing to, and the number of tons available for, each acre, do not show the amounts actually utilized in each case, but only approximately the total amounts available, whether used or wasted. The fact that water-closets are not universal must also be taken into account.

Table I.

Names of Meadows.	Imperial Acres under Irrigation.	Approximate Population contributing to each Acre.	Approximate Quantity of Sewage available for each Acre
			Tons.
Lochend, Spring Gardens, and Craigentinny	285	337	20,500
Roseburn and Western Dalry - -	80	112	17,000
Quarry Holes - - - - -	8	562	65,000
Broughton Burn - - - - -	6	1,666	102,000
The Grange - - - - - -	16½	302	97,000

1. *Lochend and Spring Gardens.*

The Lochend and Spring Gardens meadows, occupied by Mr. Sco[illegible] and under the management of Mr. Peter Taylor, comprise about [illegible] imperial acres, and are irrigated by the sewage of a large portion [illegible] Edinburgh on its way to the more extensive Craigentinny meadows. Mr. Taylor estimates that, on the average, each acre gets the flow of a stream of 12 by 8 inches, at a rate of 2 miles per hour, for 10 days [illegible] 16 hours, annually, which is equal to about 31,000 tons per acre per annum. The sewage is applied from about the beginning of March [illegible] the end of November. The herbage consists chiefly of rough meadow-grass (*Poa trivialis*), which is the most prevalent where the ground [illegible] dry, and couch (*Triticum repens*), which is the second in predominance, and grows freely, but is not so early as the rough meadow-grass. There is also a great deal of crow-foot, more particularly where the drainage is imperfect.

On a portion of higher lying land, which is irrigated by the aid of a water-wheel, worked by the sewage stream itself, and where the supply is necessarily more limited, Italian rye-grass is grown, which involves the periodical breaking up of the land. After two years under the rye-*grass a crop* of potatoes is taken, then Italian rye-grass is sown again, *and so on.* Mr. Taylor stated that if this land could be irrigated by

abundance of sewage by gravitation he should prefer to lay it down as permanent meadow.

2. *Craigentinny.*

The meadows at Craigentinny, which are the property of Mr. Christie-Miller, are under the management of Mr. Bryce. About 190 acres of permanent meadow are irrigated by gravitation. A portion of this area consists of a good loamy soil, but a part of it was only barren sand before it was laid down for sewage irrigation. During the summer the sewage is applied day and night, and all that is available is then used, excepting during floods. The sewage is also applied through a considerable portion of the winter, but then during the day only. Perhaps it is unused 70 to 80 days in the year. The general plan during the summer is to let the whole of the water go over from 2 to 2½ acres at a time, changing every 3 or 4 hours during the day, but less frequently during the night; and the application is so timed as to get over, on the average, about 60 acres per week, and to give each acre such a dressing about once in three weeks. The applications are, however, less frequent during the winter. The distribution over about 100 acres can be attended to by one man; but the cleaning of the runs, keeping the roads, &c., require additional labour. Four to five crops are obtained annually; though four, cut at the proper times, generally yield better, and leave the herbage in better condition than when five are taken. From good, well managed meadows, with sewage as liberally applied as on the gravitation meadows at Craigentinny, Mr. Bryce thinks about 60 tons of green grass should be obtained per imperial acre annually. The price varies, according to season and other circumstances, from 6*d.* to 14*d.* per cwt., on the ground, standing. The produce consists almost entirely of rough meadow-grass, which is considered the most valuable, couch, which is looked upon as a very good grass and of very rapid growth, and common rye-grass, which is also considered a good grass, but not to give so close a bottom as the others.

Arrangements are also made for irrigating some higher lying land, by raising the sewage about 20 feet, it being first brought into a large tank by means of a deep underground drain from the highest level of the natural flow, and thence pumped into open channels for surface distribution. Only about 60 imperial acres are now so irrigated, but formerly a larger area was under the treatment. The application is continued from April to October inclusive; and each plot gets six dressings, and yields three cuttings, annually. If it were not for the cost of lifting, more of this land would be laid down as permanent meadow, and much more sewage would be put upon it; but the supply being so limited by the cost of application, Mr. Bryce thinks it better to sow Italian rye-grass, break up every two years and grow potatoes, re-sow rye-grass, and so on.

3. *Roseburn and Western Dalry.*

These meadows, situated to the west of the city, stand second in point of extent and importance to those of Craigentinny. They formerly comprised 100 imperial acres or more, but are now limited to about 80, having been considerably curtailed by the encroachments of railways, and for other purposes; and as much as 1,000*l.* per acre has frequently been paid as compensation. They were laid down for irrigation by Mr. James Thomson, who commenced his operations in 1826, and they still continue under his excellent management. Part of the soil is gravelly, and part loamy, with a subsoil of clay. The sewage

coming to these meadows includes the refuse from extensive slaughter-houses, and also that from a very large distillery. It is used all the year round, both day and night, and on Sundays when it can conveniently be left to flow from Saturday night to Monday morning. In summer the water seldom goes over the same piece of land more than a few hours together—as long as may be necessary thoroughly to soak it. The land is generally watered only twice, but occasionally three times, between the cuttings. In winter the water is allowed to flow for a longer period over a given area, in order to "feed" the land as much as possible. In laying down permanent meadow for irrigation, Mr. Thomson has sometimes sown a great variety of grasses, but finding that even when he has sown 15 or 20 different kinds, most of them have in the course of a few years gradually died out, leaving only those suitable to the soil and the sewage, he sometimes selects only three or four, and in one instance transplanted couch from arable land, and reports that the piece so treated is now as good as any.

4. *The Grange.*

Next in extent to the Roseburn and Dalry sewage meadows come those of the Grange, situated to the south of the city, and farmed by Mr. Mc Gill. The area of these meadows is at present only 16½ imperial acres; but it is less now than formerly, having been contracted for want, as was stated, of a sufficient supply of sewage. Indeed, the opinion given by Mr. Mc Gill, junior, was, that the greater the amount of water applied the better. The Table (p. 198) shows that the population within the area contributing to these meadows, and the amount of fluid available per acre, are, however, very large. On the other hand, the district is but imperfectly provided with water-closets, and the sewage is probably very dilute. The flow is frequently shifted only once a day, though sometimes three or four times, and in the spring, before the first cutting, generally as much as twice. The water is, as a rule, applied the day the grass is removed. The application is continued through the greater part of the winter, excepting where the last crop has been fed off. Perhaps the sewage is unused about six weeks in the year. The land is heavy, and rather steeply inclined. To a few plots on one side of the valley sewage is applied by gravitation, through a pipe carried across from a higher level of the natural flow on the opposite side.

The herbage contains no clover; and is, in fact, very soon brought down to a very simple character. It contains much couch, and also in some parts a good deal of crow-foot. When the plots are well managed four or five cuttings are obtained during the season. The crops of 1862 were sold at sums varying from 13*l.* to 38*l.* 5*s.* per imperial acre; the difference depending much upon the amount of sewage, the character of the land, the aspect, and the previous management of the cuttings, all of which affect the amount and character of the produce; but the convenience of position for cartage, proximity to other plots held by the purchaser, and other incidental circumstances, also sometimes affect the rates given for individual plots considerably.

Mr. McGill was of opinion that very much depended upon the quantity and strength of the sewage applied, and stated that portions of the land which had been irrigated by comparatively strong sewage were much more productive than others irrigated by almost pure water.

5. *Rose Bank, Broughton Road.*

These meadows, under the management of Mr. William Reid, comprise a little more than six imperial acres, and have been under irrigation

about 30 years. They are watered about 11 months in the year, at a cost of two shillings per week, given to a labourer who does the work of application at his meal-times and in over-time. The runs are, however, cleaned out in the winter by extra labour, paid for by the sale of the refuse, which commands about 2*s*. 6*d*. per ton. As the Table shows, the quantity of sewage available is enormous, being about 100,000 tons per acre per annum. Mr. Reid considered that quantity of water was a very important point, but that his supply was sufficient for considerably more land. He had not any more, however, at a convenient level, and did not consider that it would pay to be at any expense in raising the sewage. The irrigation is continued throughout the greater part of the winter as well as in the summer, and on Sundays as well as on other days. The water is applied to the same plot for three or four consecutive days, and the land gets, on the average, two such dressings for each cutting. It is considered better not to apply the sewage immediately after cutting, but to wait a few days until the grass has begun to shoot. The water does not run off the land clear. Four or five cuttings are obtained annually. The plots are from one-quarter to half an acre each, and they let at rates which amount to from 25*l*. to 30*l*. per imperial acre.

Mr. Reid's supply of sewage being so abundant, and having garden ground lying conveniently for its application, he occasionally applies it to about two acres; but he stated that he would go to very little expense in arrangements for the application of such small quantities as could be so used. The garden crops for which the sewage was found to be the most useful are turnips, cabbages, and onions.

6. *Quarry Holes.*

The Quarry-Holes meadows, farmed by Mr. Thomas Skirving, comprise only about eight imperial acres, and the amount of sewage available per acre is very large, being about 65,000 tons per annum. The whole is in permanent meadow. The sewage is applied day and night, and on Sundays, the whole year round, excepting during very hard frost. A plot of an acre, more or less, receives the supply for about two days at a time, and gets three such dressings between the cuttings; but the water is not put on until two or three days after cutting, nor is it considered desirable to apply it when the grass is far advanced. As the Table shows, the amount of population contributing to each acre is greater in the case of these meadows than in that of any other in the neighbourhood of Edinburgh, excepting those of Rose Bank, and the amount of water is also very large. There is no doubt that there is very extravagant expenditure of manurial constituents here, as there is indeed in all the other cases; but it must, at the same time, be admitted that it is under these conditions that a greater amount of produce is obtained per acre under the influence of sewage than anywhere else, and perhaps among all the Edinburgh sewage meadows those of the Quarry Holes stand second to none in point of evenness of herbage, and amount and value of produce per acre. The prevailing grasses are rough meadow-grass and common couch.

APPENDIX No. 3.

Notes on the Sewage-irrigated Meadows at Beddington near Croydon.

The following particulars were obtained on the spot, partly from Mr. Latham the engineer to the Croydon Local Board of Health, and partly from Mr. Marriage, junior, son of the gentleman who rents and farms the irrigated meadows.

The population of Croydon contributing to the sewage tanks is about 16,000; and the water contributed to them is estimated at about 40 gallons per head per day without rainfall, and to average, the year round, perhaps 60 gallons per head per day with rainfall. These amounts are equal to about 65 tons per head per annum without, and 98 tons with rainfall. About 300 acres are rented by the Board at 4*l.* per acre without sewage, and sub-let to Mr. Marriage at 5*l.* per acre with sewage. Up to Midsummer 1864, 260 acres had been prepared for irrigation, of which about 250 might be considered as actually under irrigation during the year. It was intended to have 90 to 100 acres constantly under Italian rye-grass, but as yet not so large an area was under that crop.

The plan of irrigation is to let the sewage flow over from 20 to 30 acres for about four days and nights, and to give three such dressings between each cutting. As much of the water as can be recovered for the purpose is re-distributed, and in this way a large proportion is always used at least twice, sometimes three, and even four times over, and on the average about two and a half times, by which its utilisation and purification are rendered much more complete than otherwise would be the case. According to the figures given above there are about 6,250 tons of the dilute sewage with rainfall annually available for each of the 250 acres; but as so much of the water is re-used the average amount passing over each acre is very much more. There are also annually available for each acre the excretal matters of about 64 individuals of the mixed population of both sexes and all ages.

The land under sewaged Italian rye-grass is estimated to yield at least four cuttings, and from 30 to 35 tons of green produce per acre per annum. The cuttings commence in April, and last to the end of October, and even into November. This grass sells for about 25*s.* per ton in London, and is estimated to realise from 16 to 17 shillings per ton on the land. The sewaged meadow-grass also yields at least four cuttings annually, but it is much less liked than the Italian rye-grass by the London feeders, and is generally sold on the land by the rod, or grazed, and is estimated to yield several pounds less gross money return per acre per annum than the rye-grass.

Mr. Marriage does not apply the sewage in any systematic way to any other crops than permanent meadow and Italian rye-grass, but was about to try it on a small scale to mangolds.

There was a proposition under consideration by the Board to enlarge the area by 100 to 150 acres, which, notwithstanding the rapid increase of the population and of the sewage of the district, will, if carried out, considerably reduce the number of population contributing, and the amount of sewage available, to each acre annually.

About 180 tons of moist solid matter are annually deposited, or intercepted by the strainers, at the tanks, and are sold by the Board at a very low price per ton.

Before the above arrangements for passing the sewage of Croydon *over the land* were made, the Board were constantly subjected to legal

proceedings on account of the pollution of the river Wandle by the discharge of the sewage into it; but now those having the right of the fishing in the river have found it worth while to put down gratings to prevent the fish ascending the drainage outfall from the sewage-irrigated land.

In the following Table are collected together the results of some partial analyses of Croydon sewage, drainage, &c., which have been kindly communicated by Mr. Latham. The first four analyses are given on the authority of Messrs. Way, Evans, and R. D. Thomson, and the remainder on that of Messrs. Way and Evans alone.

TABLE I.—Results of the Analysis of the Water of the River Wandle, and of the Sewage of Croydon before and after Irrigation.

—	Grains per Gallon.			
	Inorganic Matter.	Organic Matter.	Total Solid Matter.	Ammonia.
Samples collected October 1861.				
River Wandle above sewage outfall	18·56	1·44	20·00	0·18
Do. do. below sewage outfall	20·16	2·08	22·24	0·18
Sewage from an independent sewer	48·30	52·20	100·50	6·70
Drainage after sewage irrigation	23·40	2·40	25·80	0·21
Samples collected November 16, 1861.				
Sewage before reaching the tank, 11 a.m.	26·30	12·80	39·10	..
Drainage after sewage irrigation, 12.30 p.m.	21·25	6·50	27·75	..
Do. do. do. do. 2.30 p.m.	26·30	2·40	28·70	..
Do. do. do. do. 4.30 p.m.	25·50	3·45	28·95	..
Samples collected November 18, 1861 (after a sharp frost).				
Drainage after sewage irrigation, 2 p.m.	20·65	2·65	23·30	..
Do. do. do. do. 4 p.m.	20·95	2·90	23·85	..

The above analyses do not show what proportion of the several constituents existed in suspension and solution respectively; and, of the two samples of sewage, that collected November 16 contained, even before reaching the land, comparatively little solid matter of any kind. So far, however, as can be judged from these few, and little more than initiative results, it would appear that the water was to a considerably greater degree purified by its passage over and through the land than was the case in the Rugby experiments, in which the arrangements did not admit of the fluid being used two or three times over as with the more extended area at Croydon. The subject of the composition of the drainage-water passing from land liberally sewaged, but under arrangements for the re-distribution of the water until it is as far as practicable both utilised and purified, is, however, one of great importance, still requiring careful investigation.

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REPORT

OF

EXPERIMENTS UNDERTAKEN BY ORDER OF THE BOARD OF TRADE

TO DETERMINE THE

RELATIVE VALUES OF UNMALTED AND MALTED BARLEY

AS FOOD FOR STOCK.

Presented to both Houses of Parliament by Command of Her Majesty.

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CONTENTS.

PART I.

INTRODUCTORY OBSERVATIONS, AND NOTICE OF PREVIOUS EXPERIMENTS.

PART II.

THE EXPERIMENTS MADE IN 1863-4 BY ORDER OF THE BOARD OF TRADE.

APPENDIX.

[redacted]

REPORT OF EXPERIMENTS,

&c.

PART I.

Introductory Observations, and Notice of previous Experiments.

It seems to have been established by experience that malt, given in moderate proportion, in admixture with other food, is much relished by most of the animals of the farm, and that it frequently exercises a beneficial influence upon their health and progress, more especially in the case of young or weakly animals. There are, however, so far as we are aware, no accounts on record showing either a greater amount of milk, or a greater amount of increase in live-weight, from the use of a given amount of malt than from that of the amount of barley from which it would be produced. On the contrary, all the trials with which we are acquainted, in which weights have been accepted as the measure of the result produced, have shown a better yield from a given amount of barley than from the amount of malt that would be produced from it. At the same time, it must be admitted that the evidence of some observers appears to show that, so far as quality is concerned, the meat of animals receiving a certain amount of malt in their food ranks deservedly high, and in a few cases in which the trials have been comparative it has been pronounced to be higher than when barley instead of malt was employed.

In the trials the results of which it is the object of this Report to record, 20 milking cows, 20 fattening oxen, 60 sheep, and 48 pigs have been experimented upon. Most of the experiments were arranged to compare the effects of a given amount of barley with those of the malt (and its dust) produced from an equal amount of barley taken from the same stock; and although

the quality, both of the milk and the meat produced, has not been overlooked, the *weight*, whether of milk or increase, has been taken as the chief measure of the effect produced.

Before detailing the results of these new experiments it will be well to give a brief summary of the results of any former experiments in which weights have been carefully taken and recorded.

I.—The Experiments of Drs. T. and R. D. Thomson, in 1845–6.

In 1845–6, the late Drs. Thomas and Robert Dundas Thomson, of Glasgow, made experiments on the relative qualities of barley and malt as food for stock. From June 24 to September 3, 1845, they experimented upon two milking cows, and from October 1, 1845, to January 16, 1846, upon two fattening oxen. The results of their inquiry are recorded in an official report.*

1. *The Experiments with Cows.*

In the experiments with the two cows both animals were kep upon the same description of food for a certain number of days in no case exceeding 16, and then, sometimes with, and some times without a short interval, they were put upon the food th results of which were to be compared with those of that pre viously given.

It is unfortunate that so few as two animals were take though it would doubtless have been very difficult for the D Thomson to have followed out their elaborate inquiry with larger number. It is also much to be regretted that the durati of each experiment was so short, that there was such a freque change of food, and that (as was the case with the cows) t periods during which the foods to be compared with one anot were given were successive instead of parallel.

The following is a summary of the Drs. Thomson's resu with cows, calculated from the records given in the Report, a arranged in a convenient form for showing the comparat effects of barley and malt in the different experiments. experiments 1 and 2 the barley and malt were given entire, in experiments 3, 4, and 5 they were crushed, and in all t were steeped in hot water before being given to the animals.

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* Reports to Her Majesty's Government in respect to Feeding of Cattle Malt, April, 1846.

Table I.—Calculated Summary of the Drs. Thomson's Experiments with Cows.

	Food consumed.				Increase (or Loss) in Live-weight.	Milk yielded.		
	Total.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.	To produce 100 lbs. Milk.		Total.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.
Experiment 1.—Two Cows; Special Food—Barley; Period 11 Days.								
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Barley	95	4·3	30·1	21·3	−41	447	20·3	141
Grass	1880	85·5	595·4	420·9				
Experiment 2.—Two Cows; Special Food—Malt; Period 10 Days.								
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Malt	112	5·6	38·6	28·4	−22	394	19·7	136
Grass	1700	85·0	585·2	431·5				
Experiment 3.—Two Cows; Special Food—Barley; Period 16 Days.								
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Barley	282	8·8	59·7	40·7	89	693	21·7	147
Malt	6	0·2	1·3	0·9				
Grass	532	16·6	112·6	76·8				
Hay	763½	23·9	161·6	110·2				
Experiment 4.—Two Cows; Special Food—Malt; Period 16 Days.								
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Barley	6	0·2	1·3	0·9	7·5	655	20·5	139
Malt	336	10·5	71·2	51·3				
Hay	882½	27·6	186·8	134·7				
Experiment 5.—Two Cows; Special Food—Barley; Period 5 Days.								
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Barley ..	116	11·6	78·9	57·2	−21·5	203	20·3	138
Hay	264	26·4	179·5	130·2				

In the experiments of the Drs. Thomson screened malt, without the malt dust, was employed, and the exact proportion of the malt to the barley from which it was produced was not recorded. In the above Table (I.), therefore, the figures relating to malt represent the actual amounts of malt given, and not the amounts of barley from which the malt would be produced, as is the case in most of the Tables embodied in this Report.

The table shows that in each of the comparative trials a greater weight of screened malt than of barley was consumed

for the production of a given amount of milk ; and if the figu were amended so as to represent the amount of barley fr which the malt had been produced, the results would of cou appear still more unfavourable to the malted as compared wi the unmalted barley.

2. *The Experiments with fattening Oxen.*

In all the experiments of Dr. Thomson with oxen the barley or the malt, as the case might be, was ground and mixed into mash with hot water before being given. Each comparativ experiment was parallel as to time, instead of successive as i the case with the cows; but only one animal was put on eac description of food, the one receiving barley being designated a Bullock "A," and the one receiving malt as Bullock "B There were five periods of experiment, one of 14, one of 15, or of 11, one of 17, and one of 18 days, in some cases with, and i some without, an interval between the periods, which, togethe extended from October 1, 1845, to January 16, 1846, making total period of 108 days, out of which the animals were und exact experiment only 75 days.

The following is a calculated summary of the results obtain during the five separate periods, amounting to 75 days in all.

TABLE II.—CALCULATED SUMMARY of DR. THOMSON'S EXPERIMENTS with Bu

—		Food consumed. Total.	Food consumed. Per Head per Day.	Food consumed. Per 1000 lbs. Live-weight per Week.	Food consumed. To produce 100 lbs. Increase.	Increase in Live-w Total.	Increase in Live-w Per Head per Week.	P L I
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
Bullock A.	Barley ..	766	10·2	64·5	411·8	186	17·4	
	Hay	876¾	11·7	73·9	471·3			
	Cake ..	55¼	0·7	4·7	29·8			
	Roots ..	1904	25·4	160·4	1023·7			
Bullock B.	Malt	768	10·2	54·0	376·5	204	19·0	
	Hay	1008	13·4	70·8	494·1			
	Cake ..	55	0·7	3·9	27·0			
	Roots ..	1904	25·4	133·8	933·3			

It will be obvious that no very satisfactory conclusions can l formed from results obtained with single animals only in eac case, and over such short periods as those adopted in the experiments; but, under the conditions stated, the results we as follow:

During the first 14 days the Bullock A, on barley and ha gave more increase than Bullock B, on malt and hay, ar required less food to yield a given amount of increase.

For two or three weeks from the conclusion of the above experiment the animals suffered from foot disease accompanied with fever, then very prevalent. On recovery the comparative trial was resumed for 15 days, Bullock A having barley, hay, and roots, and Bullock B malt, hay, and roots. The result was again in favour of the unmalted barley, both in regard to the actual amount of increase in live-weight and to the amount of food required to yield a given amount of increase.

The next period was consecutive with the last, and extended over 11 days. During this period the turnips were found to be much diseased, and both animals suffered in consequence, especially the one having barley, which gave much less increase than the other.

The next period was one of 17 days, was consecutive with the preceding one, and the weights were considerably in favour of the bullock having barley.

The fifth and last period commenced 10 days after the conclusion of the preceding one, lasted 18 days, and the result was in favour of the malt.

The Table (II.) gives the results of these five periods collectively. It is seen that Bullock B, receiving malt, gave, under the conditions stated, rather more increase than the Bullock A, receiving barley, and also consumed less malt to yield a given amount of increase than the other did of barley. But if the comparison were made, not between the actual weights of barley and malt, respectively, that were consumed, but between the amount of barley actually consumed in the one experiment, and the amount of barley from which the malt consumed in the other would be produced, the result would then be found to be in favour of the unmalted instead of the malted barley.

With fattening bullocks, then, as with milking cows, the results obtained by the Drs. Thomson were unfavourable to the use of malted as compared with unmalted barley, and the conclusions they drew on the subject were consistent with the result here stated.

II.—Experiments at Rothamsted, in 1848, 1849, and 1854.

1. *The Experiments in* 1848 *and* 1849, *with Sheep.**

A summary of the results obtained under this head is given in the following Table (III.).

* 'Agricultural Chemistry: Sheep Feeding and Manure.' ('Journal of the Royal Agricultural Society of England,' Vol. X., Part I.)

Table III.—Summary of Results obtained at Rothamsted, in 1848 and with Sheep.

—	Food consumed.				Increase in Live-we		
	Total.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.	Total.	Per Head per Week.	Pe Liv pe
Experiment 1.—From June 5 to October 17, 1848 = 19 Weeks and 1 Day; under							
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
5 Sheep { Barley (ground)	665	1·0	5·2	479	139	1·47	
Clover Hay ..	1986	3·0	15·6	1429			
5 Sheep { Malt (ground) ..	625	0·94	5·0	517	121	1·28	
Clover Hay ..	1974	2·9	15·7	1631			
Experiment 2.—From March 20 to May 29, 1849 = 10 Weeks; under Cove							
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
4 Sheep { Barley (ground)	280	1·0	5·0	346	81	2·03	
Mangolds ..	3867	13·8	69·1	4774			
5 Sheep { Malt (and Dust) ground	283	0·81	4·0	270	105	2·09	
Mangolds ..	4694	15·2	66·5	4470			
Experiment 3.—From March 20 to May 29, 1849 = 10 Weeks; under Cov							
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
4 Sheep { Barley (ground and steeped)	280	1·0	4·8	276	101½	2·53	
Mangolds	5322	16·8	90·5	5243			
4 Sheep { Malt (and Dust) ground and steeped	227	0·81	3·8	291	78	1·97	
Mangolds	4458	15·9	74·5	5715			
5 Sheep { Malt (and Dust) ground	350	1·0	4·9	324	108	2·16	
Mangolds	5404	15·4	75·0	5004			
Experiment 4.—From March 12 to May 14, 1849 = 9 Weeks; folded in the F							
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
27 Sheep { Barley	851	0·5	2·5	182	468	1·92	
Clover Chaff ..	851	0·5	2·5	182			
Swedes (ad lib.)	..	..	..	..			
27 Sheep { Malt (and Dust)	680	0·4	2·0	156	437½	1·80	
Clover Chaff ..	851	0·5	2·5	194			
Swedes (ad lib.)	..	..	..	..			

In experiment 1 the design was to give equal weights of barley and of malt, 1 lb. per sheep per day, but not quite so much of the malt was consumed. The complementary food was in both cases clover-chaff, which, with water, was given *ad libitum*, but weighed, and the experiment was continued for 19 weeks. The Table shows, not only that the sheep having unmalted barley gave a greater actual increase in live-weight, but also that it required a greater weight of malt than of barley to yield a given amount of increase. The result was in reality still more unfavourable to the malt than the figures show, for the 517 lbs. of screened malt consumed to produce 100 lbs. of increase would have required about 645 lbs. of barley to produce it, whereas only 479 lbs. of raw barley were consumed to produce 100 lbs. of animal increase.

In the second experiment, as in the first, the sheep were fed under cover. The plan was to give to one lot 1 lb. of barley per head per day, to another the amount of malt and malt-dust produced from 1 lb. of barley, and to both mangolds *ad libitum*, but weighed. The barley and the malt were ground; and the experiment was continued for ten weeks, with four sheep on the barley, and five on the malt diet. As the figures stand, the result appears considerably in favour of the malt; and even when the malt and malt-dust consumed are calculated up to the amount of barley from which they would be produced, the result is still slightly in favour of the malt as regards the amount of food required to produce a given amount of increase in live-weight.

The plan of experiment 3 differed little from that of experiment 2. In the first pen the amount of barley, and in the second the amount of malt, with its dust, were the same as before, but each was now steeped for some time as well as ground before being given. In the third pen each sheep received 1 lb. of malt (with its dust) per head per day, that is, the same weight as those in pen 1 received of barley, instead of, as in pen 2, only as much as would be produced from 1 lb. of barley, and instead of being both ground and steeped, the malt was now only ground. Comparing the result of pen 1 with barley ground and steeped, with that of pen 2 with malt both ground and steeped, it is decidedly in favour of the unmalted barley, and of course more so than the figures show if the amount of malt consumed be reckoned up to the amount of barley from which it would be produced. The result of pen 3 with the increased amount of malt, but only ground, and not afterwards steeped, is still more unfavourable to its use.

As a control to the above experiments, in all of which the

sheep were fed under cover, in some with clover-hay without any succulent food, and in others with mangolds (themselves highly saccharine) in addition to the barley or the malt, another experiment, No. 4, was made, in which there was a larger number of sheep (twenty-seven) in each lot, the animals were folded in the open field, they received only about half as much barley or malt per head per day, ¼ lb. clover-chaff per head per day, and swedes *ad libitum* and unweighed. To lot 1 the daily allowance of barley was ½ lb. per head, and to lot 2 as much malt with its dust as was produced from ½ lb. of barley, and the experiment was continued for nine weeks.

The rate of increase upon a given live-weight within a given time was somewhat under the average obtained when sheep are liberally fed on fattening food, and was not equal to that in experiments 2 and 3, in which the animals had mangolds, and were fed under cover. The total increase of the lot having barley was 468 lbs. against 437½ lbs. on the lot having a corresponding amount of malt; and reckoning the malt (and dust) consumed to produce 100 lbs. of increase up to the amount of barley which it represented, the result was decidedly in favour of the unmalted as compared with malted barley.

It is seen, then, that in only one of these earlier comparative trials with sheep was the result in favour of malt as compared with the amount of barley from which it would be produced. The results of the Drs. Thomson, with milking cows and fattening oxen, also afforded preponderating evidence in favour of the use of unmalted rather than malted barley, as a staple food for stock.

So far as we are aware there are no other comparative trials of barley and malt recorded, in which the weights of the food consumed, and of the milk or increase in live-weight yielded, have been taken as the measure of the effects produced. It is true that there are records enough of trials in which malt has been shown to be a good food for stock, and no further evidence on that point can be needed. But whether or not the favourable result, so far as the health and progress of the animals are concerned, has been economical compared with what it would have been had raw barley been used instead, is quite another matter; and it is the question of the comparative economy of unmalted and malted barley as food that the experiments above quoted, and those to which this report has special reference, have been undertaken and arranged to throw light upon.

2. *The Experiments in* 1854 *with Pigs.**

Independently of certain theoretical considerations, one object of these experiments was to determine whether any or what benefit would be likely to accrue, either to the growers of sugar, or to the agricultural interest of this country, if the lower qualities of cane-sugar were admitted duty-free for the feeding of animals; another was to provide data bearing upon the question whether or not any advantage would result from the conversion of a portion of the starch of the food of animals into sugar by subjecting it to the malting process.

The plan adopted was, to give to each of several lots of Pigs a fixed amount of lentil-meal and bran, enough to supply all the nitrogenous matter that they would require, but leaving them deficient in the necessary amount of the non-nitrogenous constituents of food, which were supplemented in one experiment by as much starch, in another by as much sugar, and in another by as much of both starch and sugar, as the animals chose to eat; whilst in a fourth experiment they were allowed to take lentil-meal, bran, starch, and sugar, each separately and *ad libitum.*

The results given in the following Table (IV.) of the first two of the experiments above referred to, in which both lots of animals had the same amount of lentil-meal and bran, but the one starch and the other sugar, in addition and *ad libitum,* bear the most directly upon the questions here under consideration.

TABLE IV.—EXPERIMENTS with PIGS, on the Equivalency of STARCH and SUGAR in FOOD.

Period of Experiment 10 weeks; February 27 to May 8, 1854.

—	Food consumed. Total.	Food consumed. Per Head per Day	Food consumed. Per 100 lbs. Live-weight per Week.	Food consumed. To produce 100 lbs. Increase.	Increase in Live-weight. Total.	Increase in Live-weight. Per Head per Week.	Increase in Live-weight. Per 100 lbs. Live-weight per Week.
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Pigs: Lentil-meal	672	3·20	16·4	272	247	8·23	6·03
Bran	126	0·60	3·1	51			
Sugar, ad libitum (¹)	388½	1·85	9·5	157			
Containing dry substance	(363½)	(1·73)	(8·9)	(147)	..	..	..
Pigs: Lentil-meal	672	3·20	16·4	271	248	8·27	6·06
Bran	126	0·60	3·1	51			
Starch, ad libitum (²)	450½	2·15	11·0	182			
Containing dry substance	(362¼)	(1·73)	(8·9)	(146)			

* 'On the Equivalency of Starch and Sugar in Food.'—Report of the British Association for the Advancement of Science for 1854.

It is seen that the two lots consumed almost identical a
both of lentil-meal and bran, whether reckoned per head p
per 100 lbs. live-weight per week, or to produce 100
increase; but that the one lot consumed in addition consid
less of the raw sugar than the other did of the raw starc
however, the amounts of water which the sugar and the
contained in the condition in which they were respectivel
to the animals be deducted from the actual weights consu
is found, as shown by the figures given in parenthesis
Table, that the amounts of real dry or solid substance con
were all but absolutely identical in the two cases. Indeed
it is borne in mind that the animals were dependent on th
or the starch supplied to them for about one-third of th
solid matter of their food, and that in each case they were a
to take as much as they chose, the coincidence in the a
of dry or solid substance consumed in the two cases i
striking.

The amounts of increase, whether reckoned per head
100 lbs. live-weight per week, were also all but identical.

The results of these experiments indicate an almost
equivalency of the dry or solid substance of cane-sugar
starch in the food of the pig, provided, of course, that neit
given in undue proportion, and that other constituents be
same time supplied in sufficient amount; indeed, the tw
bably only differ in point of fact in relative food capacity,
very slight proportion in which they are known to differ
centage amount of carbon.

If, then, cane-sugar have no higher, and perhaps even a s
lower, value as a constituent of food than starch, a consid
of the relative prices of sugar duty-free, and of the starchy
generally used for feeding, and also of the fact that the l
the same time supply a considerable amount of the neede
genous constituents of food, will afford an easy means of esti
the relative economy of the two.

As cane-sugar contains somewhat less carbon than a
weight of starch, so does the saccharine matter of malt
in its turn somewhat less than an equal weight of the s
the cane; hence, so far as composition is concerned, it w
concluded, *à priori*, that a given weight of cane-sugar woul
a higher value as a constituent of food than an equal we
the sugar of malt; on the other hand, the sugar of malt i
nearly allied to that which is the product of the transform
starch within the animal body than is that of the cane.

The most obvious conclusion from these experiment
that there would be no economy in substituting a

of the starchy grains usually used as food by a corresponding amount of the sugar of the cane; and a very probable conclusion was, that there would be as little or less advantage from the conversion of a certain amount of the starch of food into the sugar of malt by subjecting the starchy grains to the process of malting.

We proceed now to consider the experiments which form the special subject of the present Report.

PART II.

The Experiments made in 1863-4 by Order of the Board of Trade.

1. The Selection of the Barley, the Malting, and the Composition of the Unmalted and the Malted Grain.

1. *The Selection of the Grain, the Malting, &c.*

In order to determine fairly the comparative feeding quality, and the comparative economy as food, of unmalted and malted barley, it was decided to employ malt produced from barley taken from the same stock as that given for comparison in the unmalted state; and to give to parallel lots of animals, in one case a given amount of barley, and in another the amount of malt (with its dust) which was found in actual working to be produced from that amount of raw barley. It was also thought desirable to employ in some of the experiments barley of a quality admitted to be well adapted for the malting process, and in others such as would not be considered suitable for making brewer's malt, but which would be considered well adapted for feeding, and to determine the amount and composition, not only of the final products (malt and malt-dust), but also of some of the intermediate products of the malting of each of the descriptions of grain selected.

In order to accomplish these ends it was necessary to have access to, and liberty to disturb, and take samples from, the "floors," during growth. The Board of Excise having been communicated with, arrangements were made for conducting the operations in one of the maltings of the Messrs. Gripper, at Hertford, and ample facilities were afforded for doing all that might be deemed desirable, subject only to the observation of

an officer appointed for the purpose by the Surveyor of district.

These matters being arranged, 70 quarters of barley, of but not first-class, malting quality, were purchased. Half reserved to be consumed in the raw state, and half was m: and screened in the usual way. For distinction, this lot wi designated No. 1.

70 quarters of barley of fair feeding quality were also chased, half reserved to be consumed in the raw state, and other half malted, &c., as No. 1. This lot will be desigr No. 2.

The grain was measured over, every eighth bushel weig and samples were taken in the raw state, at different stag growth, and when completely malted, in order to have the m of determining, by analysis and calculation, the amour chemical change, and of loss, during the malting process.

The following Table (IV.) shows the quantity, both by me: and weight, of each lot of barley malted, and also the qua and proportion of malt and malt-dust produced in each case, correction having been made for the quantities remove samples during the process.

TABLE IV.—SHOWING the QUANTITIES of BARLEY MALTED, and of MA MALT-DUST produced.

—		Measure.	Weight per Bushel.		Total Weight.	Malt to 100 Barley; by Measure.	Malt and Dust to 100 Barley; by Weight.
		Bushels.	Lbs.	oz.	Lbs.		
Barley No. 1.	Unmalted ..	280	54	10	15,295	..	..
	Malted ..	290	41	10	12,072½	103·6	78·9
	Malt-dust ..	..	..		336	..	2·2
Barley No. 2.	Unmalted ..	280	50	10	14,175	..	..
	Malted ..	284	37	4	10,578	101·4	74·6
	Malt-dust ..	..	..		454½	..	3·2

It is seen that the malt from the good malting barley, N measured about 3½ per cent., but that from the feeding ba No. 2, scarcely 1½ per cent. more than the barley from whi was produced. In weight, however, both lost considera No. 1 about 21, and No. 2 about 25½ per cent., reckoning the screened malt as a product of the process; but, even inclu the malt-dust as a product, the loss in weight was, with b No. 1 about 19, and with barley No. 2 a little over 22 cent.

The question arises—of what does this loss in weight by lting consist?

Before fully considering this point it will be well to call ention to the difference in the per-centage composition of the ley, and its products at different stages of growth, as shown the results of the analyses, without the aid of which that estion could not be answered.

The Analysis and the Per-centage Composition of the unmalted and the malted Barley.

For the purpose of these determinations a sample of 25 lbs. s taken from the grain in the dry state before steeping, after eping when thrown out from the couch, at intervals of several ys during growth, and when completely malted and screened.

As soon as the samples were taken they were sent to the thamsted Laboratory, and there at once stove-dried for pre- vation. The analyses were also all made at Rothamsted; but should be observed that the determinations of the sugar were de by Mr. Hugh Morris, of the Inland Revenue Laboratory, merset House, who was kindly sent down by Mr. George illips, the able Director of that laboratory, to assist in the lytical work.

Some particulars relating to the analyses will be found at . 56-58, and the detailed results are given in Tables I.-V., . 59-63, in the Appendix.

Table V. (p. 18) summarises, for barley No. 1, the composi- n of the grain at the different stages; the upper division owing the composition of the specimens in the condition of isture in which they were sampled; the middle division the nposition of the dry or solid substance, that is, exclusive of all isture in each case; and the lower division, that of the barley its natural state of dryness, of the malt and malt-dust as kiln- ed, and of the intermediate products of growth assuming each have been brought to the same condition of dryness as the n-dried malt.

Table VI. (page 19). shows the same particulars for barley . 2 as does Table V. for barley No. 1.

For comparison with the results in these two tables, Table II., p. 66 in the Appendix, gives similar particulars, so far as y were obtained, relating to the barley, and the preparation of malt, used in some of the experiments with sheep at Roth- sted in 1849.

Owing to the very great difference in the amount of moisture the different specimens in the condition in which they were mpled for analysis (the barley being in the usual marketable

TABLE V.—SHOWING the COMPOSITION of BARLEY No. 1, before Malting, at differe Stages of the Process, and when completely Malted.

	Barley, before steeping	Growing. Nov. 2. As thrown from the Couch.	Nov. 6. 4½ Days on the Floor.	Nov. 10. 8 Days on the Floor.	Nov. 12. 10½ Days on Floor (1st third to Kiln).	Nov. 14. 12½ Days on Floor (2d third to Kiln).	Nov. 16. 14½ Days on Floor (3d third to Kiln).	Screened Malt
1.—In the condition of Moisture as sampled.								
Sugar	2·11	0·89	4·74	5·95	No sample taken.	6·92	7·23	10·39
Starch (and dextrine)	66·24	46·49	43·44	42·10		41·94	41·75	67·23
Woody-fibre	3·86	3·00	2·88	3·02		2·95	2·99	4·51
Albuminous (or "flesh-forming") matters*	8·09	5·63	5·75	5·92		6·09	6·19	9·29
Mineral matter (ash)	2·06	1·30	1·32	1·36		1·39	1·40	2·03
Total solid matter	82·36	57·30	58·13	58·35		59·29	59·56	93·34
Moisture	17·64	42·70	41·87	41·65		40·71	40·44	6·66
Total	100·00	100·00	100·00	100·00		100·00	100·00	100·00
* Containing nitrogen	1·28	0·89	0·91	0·94		0·97	0·96	1·47
2.—Exclusive of Moisture.								
Sugar	2·56	1·56	8·16	10·19	No sample taken.	11·67	12·14	11·01
Starch (and dextrine)	80·42	81·12	74·72	72·16		70·73	70·09	72·03
Woody-fibre	4·69	5·22	4·96	5·18		4·98	5·03	4·83
Albuminous (or "flesh-forming" matters*)	9·83	9·83	9·89	10·14		10·27	10·39	[illegible]
Mineral matter (ash)	2·50	2·27	2·27	2·33		2·35	2·35	2·17
Total solid matter	100·00	100·00	100·00	100·00		100·00	100·00	100·00
* Containing nitrogen	1·56	1·56	1·57	1·61		1·63	1·65	1·58
3.—Barley, Malt, and Malt-dust, as sampled; intermediate Products in the same conditi Dryness as Malt.								
Sugar	2·11	1·46	7·61	9·51	No sample taken.	10·90	11·33	10·39
Starch (and dextrine)	66·24	75·72	69·75	67·35		66·01	65·42	67·23
Woody-fibre	3·86	4·88	4·63	4·84		4·65	4·70	4.51
Albuminous (or "flesh-forming") matters*	8·09	9·17	9·23	9·47		9·59	9·70	9·29
Mineral matter (ash)	2·06	2·11	2·12	2·17		2·19	2·19	2·03
Total solid matter	82·36	93·34	93·34	93·34		93·34	93·34	93·34
Moisture	17·64	6·66	6·66	6·66		[illegible]	6·66	6·66
Total	100·00	100·00	100·00	100·00		100·00	100·00	100·00
* Containing nitrogen	1·28	1·46	1·47	1·50		1·52	1·54	1·48

VI.—Showing the Composition of Barley No. 2, before Malting, at different Stages of the Process, and when completely Malted.

	Barley, before steeping.	Growing. Nov. 6. As thrown from the Couch.	Nov. 10. 4 Days on the Floor.	Nov. 14. 8 Days on the Floor.	Nov. 17. 11 Days on Floor (1st third to Kiln.)	Nov. 19. 13 Days on Floor (2d third to Kiln.)	Nov. 21. 15 Days on Floor (3d third to Kiln).	Screened Malt.	Malt-dust.
1.—In the Condition of Moisture as sampled.									
. . . .	2·83	1·14	3·73	6·13	5·95	6·29	6·86	11·34	10·88
dextrine) . . .	61·76	42·45	40·16	38·43	38·26	39·74	39·85	64·79	37·06
. . . . .	4·47	3·06	2·86	3·15	3·32	3·27	3·58	5·48	8·41
(or "flesh-form-ters"	9·90	6·61	6·71	6·94	6·98	7·31	7·62	11·35	22·06
ter (ash) . . .	2·08	1·42	1·40	1·54	1·60	1·65	1·68	2·37	7·82
solid matter . .	81·04	54·63	54·86	56·19	56·11	58·26	59·59	95·33	86·23
ure	18·96	45·32	45·14	43·81	43·89	41·74	40·41	4·67	13·77
Total . . .	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
nitrogen . . .	1·57	1·05	1·06	1·10	1·11	1·16	1·21	1·80	3·50
2.—Exclusive of Moisture.									
. . . .	3 49	2·08	6·80	10·91	10·61	10·79	11·51	11·89	12·62
dextrine) . . .	76·21	77·63	73·21	68·40	68·19	68·22	66·88	67·97	42·98
. . . . . .	5·51	5·60	5·22	5·60	5·91	5·61	6·01	5·75	9·75
(or "flesh-form-tters"	12·22	12·10	12·22	12·35	12·44	12·54	12·79	11·91	25·58
tter (ash) . . .	2·57	2·59	2·55	2·74	2·85	2·84	2·81	2·48	9·07
solid matter . .	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
nitrogen . . .	1·94	1·92	1·94	1·96	1·97	1·99	2·03	1·89	4·06
ey, Malt, and Malt-dust, as sampled; intermediate Products in the same condition of Dryness as Malt.									
. . . .	2·83	1·99	6·48	10·40	10·11	10·29	10·98	11·34	10·88
dextrine) . . .	61·76	74·00	69·79	65·21	65·01	65·01	63·75	64·79	37·06
e	4·47	5·34	4·98	5·34	5·63	5·35	5·73	5·48	8·41
) or "flesh-form-tters"	9·90	11·53	11·65	11·77	11·86	11·97	12·19	11·35	22·06
tter (ash) . . .	2·08	2·47	2·43	2·61	2·72	2·71	2·68	2·37	7·82
solid matter . .	81·04	95·33	95·33	95·33	95·33	95·33	95·33	95·33	86·23
ure.	18·96	4·67	4·67	4·67	4·67	4·67	4·67	4·67	13·77
Total . . .	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
nitrogen . . .	1·57	1·83	1·85	1·87	1·88	1·90	1·94	1·80	3·50

condition,* the intermediate products in the wet state in after steeping they are spread on the floor to grow, and th and malt-dust kiln-dried) the results as given in the uppe sion of Tables V. and VI. do not at once bring to vie variation in the composition of the solid substance of the so clearly as those in the middle and lower divisions.

In the middle division, which shows the composition grain exclusive of all moisture, the variation in the comp of the solid substance of the grain as the sprouting proce the most strikingly brought out; but, inasmuch as in p grain malted for feeding purposes would, at whatever sta growth were stopped, (if dried at all) probably be kiln-d about the same extent as brewer's malt, it will be more to illustrate the variation in composition by reference figures given in the bottom division of the tables.

The most striking change which the figures show is t crease in the amount of sugar as the malting proceeds. I it may be said that the most characteristic effect of the m process is the conversion of a portion of the starch of the into dextrine, and then a portion of the dextrine into s changes which are effected by the agency of a substance diastase, which is itself a product of the transformation germination of a portion of the nitrogenous substance grain. It is to be observed, however, that the first s the malting process, that of steeping the grain, dissolves considerable proportion of the small amount of sugar a existing in it; and by analysis of the steep water as well grain, it is found that a certain amount both of nitrogeno mineral matters is also extracted at this stage. It is seen t the experiments to which the tables refer, the amount of was increased in one case from about 2½, and in the othe about 3½ per cent. in the dry substance of the raw grain, from 11 to 12 per cent. in that of the finished malt.

It is the substance diastase, developed during germina above referred to, which, in the process of "mashing' induces the conversion, first into dextrine and then into su the starch which has remained unchanged by the maltin it is the same substance which gives to an infusion of m property of inducing a like change in the starch of un grain, or other starchy substances mixed with it. Thi version takes place the most rapidly at a temperature of 170° F. It proceeds pretty actively, however, at ordina

* The amount of moisture in grain varies according to season and other stances. Barley in the bulk may be reckoned to contain generally bet and 18 per cent. of moisture, but samples kept in dry places, or much l may contain several per cent. less.

peratures, provided the starch have previously been gelatinized by means of hot water; and Mr. George Phillips informs us that it had been found in experiments made at the Inland Revenue Laboratory, that diastase even acts upon starch when ground malt is mixed with water at ordinary temperatures.

As the sugar produced in the process of malting is formed at the expense of the starch, which is first converted into dextrine, the amount of starch and dextrine is necessarily reduced in about the same degree that that of the sugar is increased. A portion of the sugar, however, undergoes further change during the growth, the result of which is an actual loss of some of the original non-nitrogenous substance of the grain, as will be further illustrated presently.

The proportion of woody-fibre seems to increase slightly as the growth proceeds; though it is not much higher than in the barley in any of the products of the malting process excepting the malt-dust, the dry substance of which contains about twice as much as that of either the raw barley or any of the intermediate products.

The proportion of nitrogenous or so called "flesh-forming" substances is seen to be somewhat higher in the dry or solid substance of the intermediate products of growth than in the raw barley, and in that of most of them higher than in that of the finished and screened malt. That the malt contains a somewhat lower per-centage of nitrogenous substances than the intermediate products is, of course, explained by the fact that by the screening process it has been deprived of the malt-dust, which has withdrawn nitrogen from the grain during growth, and itself contains a very high per-centage of it.

Within certain limits, the higher the per-centage of nitrogenous matters, the greater will be the value of an article of food, either as such, or on account of the richness of the manure obtained from the animals consuming it. But inasmuch as the increased proportion of nitrogenous substances in the grown grain is not due to any gain of them during the process, but, as will presently be seen, to a loss of other substances, by which it is only their proportion, and not their actual amount, that is increased, it would obviously be a delusion to conclude that there is any advantage or economical gain in the increased per-centage of those important constituents which is obtained by submitting the grain to germination; indeed, as will be seen further on, there will always be a greater or less loss of the nitrogenous substances of grain in converting it into malt, so that, so far as the feeding value is dependent on the amount of nitrogenous constituents, a given amount of grain will provide more of them in the raw state than after it has been malted. It is true that a given weight

of malt will contain a larger amount of nitrogenous substan
than an equal weight of raw barley, but that given weigh
malt will have required 1⅕th to 1¼th of its weight of raw gr
besides the cost of the process, to produce it.

From the high per-centage of nitrogenous substances in
malt-dust, it is obvious that there would be a loss, both of feed
and manurial matter, if it were not employed along with the r
whenever grain were malted for feeding purposes.

It will be observed that the feeding barley (No. 2) contai
more nitrogenous matter, and more woody-fibre, but less sta
than the better malting sample No. 1; and this differenc
composition was pretty uniformly maintained between the co
sponding products of growth of the two descriptions of gra
indeed, the samples selected as the best for malting for brew
purposes are the plumper, the more starchy, and the less ni
genous grains; whilst those employed for feeding are gener
thinner, more nitrogenous, and less starchy.

3. *The Loss of Constituents by Malting.*

In the following tables (in Table VII. for barley No. 1, anc
Table VIII. for barley No. 2) the foregoing analytical results
applied so as to show the actual and per-centage loss of con
tuents which the barley had suffered at certain stages, and at
conclusion of the malting process. At the periods selected
these estimates, not only were samples taken for analysis, but
whole quantity of grain on the floors was measured over, and
weight of every eighth bushel taken, in order to determine
total weight as already referred to. For the estimates foun
on the data so obtained absolute accuracy cannot be clain
since every individual bushel was not weighed, but it is belie
that the results sufficiently nearly represent the truth for all p
tical purposes.

It appears that, in the steeping, No. 1 barley absorbed al
43, and No. 2 barley rather more than 47 per cent. of t
weight of water. Each lost at the same time a certain am
of solid matter, which consisted mainly of saccharine, n
genous, and mineral * substances, more of which were abstra
from the less perfectly matured second quality grain than f
the other.

The greatest amount of loss of solid substance during
growth on the floor was of non-nitrogenous organic ma

* The figures do not indeed show a loss of mineral matter by steeping i
case of the second quality barley; but, inasmuch as the so-called "mi
matter" was the crude ash determined by burning, and the samples were no
from more or less of incombustible impurity, this would account for som
crepancy in the figures in relation to mineral matter.

TABLE VII.—SHOWING the LOSS of CONSTITUENTS of BARLEY "No. 1" at certain Stages, and at the Conclusion of the Malting Process.

—	Barley before steeping.	Nov. 2. As thrown from the Couch.	Nov. 6. 4½ Days on the Floor.	Nov. 10. 8 Days on the Floor.	Final Products. Sent to the Kiln Nov. 12, 14, and 16 = 10, 12, and 14 Days on the Floor. Screened Malt.	Final Products. Malt-dust.	Final Products. Total.	Loss.
				Actual Weights, lbs.				
As sampled	15,295	21,898	21,459	20,705	12,072⅓	336	12,408⅓	2,886⅓
Total dry or solid matter	12,597	12,548	12,474	12,081	11,268½	296⅓	11,565	1,032
Non-nitrogenous organic matter ..	11,044	11,030	10,957	10,574	9,902¼	191¾	10,094	950
Nitrogenous matter	1238·0	1233·2	1233·8	1225·4	1121·7	79·8	1201·5	36·5
Mineral matter	314·8	284·3	283·5	281·5	244·5	25·0	269·5	45·3
				Proportion to 100 before steeping.				
As sampled	100	143·2	140·3	135·4	78·93	2·20	81·13	18·87
Total dry or solid matter	100	99·6	99·0	95·9	89·45	2·35	91·80	8·20
Non-nitrogenous organic matter ..	100	99·9	99·2	95·7	89·66	1·74	91·40	8·60
Nitrogenous matter	100	99·6	99·7	99·0	90·61	6·45	97·06	2·94
Mineral matter	100	90·3	90·1	89·4	77·68	7·94	85·62	14·38

TABLE VIII.—SHOWING THE LOSS of CONSTITUENTS of BARLEY "No. 2" at certain Stages, and at the Conclusion of the Malting Process.

—	Barley before steeping.	Nov. 6. As thrown from the Couch.	Nov. 14. 8 Days on the Floor.	Final Products. Sent to the Kiln Nov. 17, 19, and 21 = 11, 13, and 15 Days on the Floor. Screened Malt.	Malt-dust.	Total.	Loss.
			Actual Weights, lbs.				
As sampled	14,175	20,870	19,654	10,578	454½	11,032½	3,142½
Total dry or solid matter	11,488	11,412	11,044	10,084	392	10,476	1,012
Non-nitrogenous organic matter	9,789	9,736	9,378	8,633	256¼	8,889¼	899¾
Nitrogenous matter	1404·0	1380·3	1363·6	1200·7	100·3	1301·0	103·0
Mineral matter	295·3	295·3	302·5	250·3	35·5	285·8	9·5
			Proportion to 100 before steeping.				
As sampled	100	147·2	138·7	74·62	3·21	77·83	22·17
Total dry or solid matter	100	99·3	96·1	87·78	3·41	91·19	8·81
Non-nitrogenous organic matter	100	99·5	95·8	88·19	2·62	90·81	9·19
Nitrogenous matter	100	98·3	97·1	85·52	7·14	92·66	7·34
Mineral matter	100	100·0	102·5	84·76	12·02	96·78	3·22

doubtless chiefly sugar, destroyed by decomposition, as the growth advanced.

Of nitrogenous substances, a certain but apparently not very material amount is extracted by the steep water, the partial analysis of which is given in Table VII. p. 65, in the Appendix.

During the actual processes of germination and growth, there is, so far as existing knowledge goes, no necessary loss of nitrogen unless the moist grain be allowed to get foul. Nor, perhaps, is there in the drying any really unavoidable loss; though in practice, as at present conducted, a certain amount of the young shoots or "malt-dust" (which is highly nitrogenous), always passes through the wires during the drying, and this portion would be lost as food if not as manure also.

According to the figures in the lower divisions of Tables VII. and VIII., the total loss of nitrogen or nitrogenous substances amounted in the case of barley No. 1 to about 3, and in that of barley No. 2 to about 7 per cent. of the original quantity in the grain; and whilst the screened malt from the barley No. 1 retained 90½, that from barley No. 2 only retained 85½ per cent. of the original nitrogen. Barley No. 2 was, indeed, as already stated, the thinner and the more nitrogenous. It was, moreover, one day longer on the floor, and was pronounced to be relatively to the other rather further grown, in fact rather too far, and to be somewhat exhausted and not very fresh. Hence, doubtless, the larger proportion of the nitrogen of the grain extracted by the sprouts, the larger amount in the malt-dust, and the larger amount of the latter (and so of nitrogenous substance) detached and lost in the manipulations in the kiln-drying.

It may be remarked that in the experiments made at Rothamsted on this subject in 1849 (the results of which are given in Table IX. p. 67 in the Appendix), the proportion of the nitrogen of the original grain retained by the screened malt was 86½ per cent., that recovered in the malt and kiln-dust was nearly 10 per cent., and that totally lost was about 3½ per cent. In this case, however, the grain was rather longer (about 16 days) on the floor.

Of mineral matter the necessary loss will be confined to that extracted by the steep water, and to the amount contained in that portion of the "dust" which passes through the wires during the drying in the kiln.

It may, perhaps, be safely concluded, that if malt were manufactured for feeding, the growth would not be carried so far as it is for brewing purposes; that, if screened, the malt would retain over 90, and perhaps sometimes nearer 95 per cent. of the original nitrogen of the grain; and that, including the malt-dust as a product of the process, about 98 per cent. of the total nitrogen

of the grain might be recovered, leaving only about 2 per cen as the probable average loss by extraction by the steep-wate and by the loss of a portion of the malt-dust.

The following Table (IX.) gives a condensed view of tl products and loss from 100 lbs. of barley in each of the tw experiments.

TABLE IX.—Showing the PRODUCTS and LOSS on MALTING 100 lbs. BARLEY.

		Barley No. 1.	Barley No. 2
Malt		78·93	74·62
Malt-dust		2·20	3·21
Total Products		81·13	77·83
Loss ..	Moisture	12·12	15·03
	Non-nitrogenous vegetable substance ..	6·21	6·34
	Nitrogenous substance	0·24	0·73
	Mineral matter	0·30	0·07*
		100·00	100·00

Thus, the fair malting sample (No. 1) gave about 79 per ce of its weight, and the feeding sample (No. 2) only about 74½ p cent. of its weight of screened malt. Adding the malt-du No. 1 gave rather more than 81, and No. 2 rather less than per cent. of total products. The result is, then, that ev reckoning in the malt-dust as a product of the process, there w a loss on the original weight of the barley of about 19 per cen in the one case, and of about 22 per cent. in the other. In eac case about two-thirds of the loss in weight (in the one rathe under and in the other rather over) was only moisture driven o in the kiln-drying; but there was, besides, in each case, a loss o about 7 per cent. of real solid substance or food material, o which about 6¼ was non-nitrogenous vegetable substance, fro 0¼ to 0¾ nitrogenous substance, and the remainder miner matter.

From the above facts it will be readily understood how it that the products of the malting process have a higher per-centag of nitrogenous or "flesh-forming" substances than the barle from which they were produced. There is, indeed, an actu loss of these substances; but inasmuch as there is a much great loss of the non-nitrogenous matters, and a considerable dissipatio of water in the kiln-drying, which together reduce the weight o the products to about 20 per cent. (less or more) below th of the barley from which they were produced, this diminish-

* See foot note on p. 22.

weight, though containing even a less actual amount of nitrogenous substances, nevertheless contains a higher proportion of them in 100 parts. It is obvious, therefore, as before observed, that it would be a delusion to represent the higher per-centage of nitrogenous substances in the malted grain as indicating any gain by the process, so far as the amount of those important constituents of food is concerned. There is, in fact, a loss, not a gain; but as there is a much greater loss of other matters the proportion of them in what remains is somewhat the greater.

The loss and chemical changes which barley undergoes by malting may be summarily enumerated as follow:

1. The weight of the malt, together with the malt-dust, produced from a given quantity of barley malted in the usual way, is little more than four-fifths that of the unmalted grain; about two-thirds of the loss being water, and one-third solid substance or food material.
2. The loss of solid substance consists chiefly of non-nitrogenous matters, but includes also a small amount of nitrogenous or "flesh-forming," and mineral matters.
3. A portion of the starch of the grain is converted into dextrine, and a portion of this is further converted into sugar, the amount of which is thus raised from 2 or 3 per cent. in the raw barley, to about 10 or 12 per cent. in the finished malt; and there is, besides, an actual loss of a portion of the changed starch by further decomposition as the growth proceeds.
4. The per-centage of nitrogenous or "flesh-forming" substances is higher in the diminished weight of the malted products, though the actual amount of them is less than in the raw grain from which the malt has been produced.
5. A portion of the nitrogenous substance of the grain undergoes changes by malting, by virtue of which, when the malt is digested with water, not only the previously unchanged starch of the malt itself, but the starch of a considerable amount of unmalted grain or other starchy substances mixed with it, may become converted into the more soluble forms of dextrine and sugar; the conversion taking place but slowly if cold water be employed, and the most rapidly at a temperature of about 170° F.
6. If grain were largely malted for feeding, it is probable that the growth would not be carried so far as in malting for brewing purposes, and in that case the loss of food material would be less.

The question arises—whether, by the conversion of a portion of the starch of grain into the more soluble forms of dextrine and

sugar by malting, or by the property which, under certain conditions, malted grain possesses of furthering this change, not only in its own remaining starch, but also in the starch of unmalted grain or other starchy food mixed with it, a given amount of food is thereby rendered of so much more feeding value as to compensate for the loss of food substance and the expense of the process, and leave a profit besides?

This question must be answered by means of direct feeding experiments, and we now proceed to give the results of those which have been made in the course of the inquiry to which this Report has special reference.

II.—The Feeding Experiments in 1863-4.

From the facts brought out in the foregoing section, it is obvious that, in experiments on the comparative feeding values of unmalted and malted grain, it would be quite fallacious to compare the effects of a given amount of the raw with those of an equal weight of the malted grain, without taking into account the great loss of weight in the malting. In most of the experiments to which this Report refers, therefore, a certain quantity of unmalted barley (with other appropriate food) was given to one lot of animals, and to another similar lot (having the same additional food) there was given, instead of the whole or a part of the unmalted barley, not an equal weight of the malted but only so much malt and malt-dust as were found to be produced from the quantity of raw barley for which the malted was to be substituted. In some cases, however, the barley and the malt (with its dust) were each given separately, *ad libitum*, and the amount of barley which the consumed malt and dust represented was calculated.

It was so arranged that, in some of the experiments the malt should constitute a considerable, and in others a comparatively small proportion of the total food. The data were thus provided for judging, both of the value of malt itself as a staple food compared with raw barley, and also whether or not the admixture of a certain amount of malt probably served to render other food more digestible and assimilable.

From what has been said of the properties of an infusion of malt in converting starch into the more soluble forms of dextrine and sugar, it is obvious that for the full development of the change in the food of malt-fed animals before giving it to them, it should be submitted to a process of cooking; but, if it had been decided to cook the food of the malt-fed animals, it would have been necessary, for the sake of fair comparison, to have cooked that of the barley-fed ones also; and this would have

required a duplication of most, if not all, of the feeding experiments—an extension of the inquiry which could not easily be undertaken. It was understood that the main question at issue was that of the advantage, or otherwise, of feeding animals with grain malted instead of unmalted, assuming it to be in other respects in the same condition as the unmalted grain would usually be given; and it was considered that to introduce the question of cooking would be to go beyond both the legitimate, and the most important object of the inquiry. Furthermore, as starch is known rapidly to change into sugar within the animal body, it was obviously a question whether the use of malt, if beneficial at all, might not be so by accelerating this change within the body, as, when mixed with water, it induces it without the body, especially when aided by a certain amount of heat.

The description and number of animals subjected to experiment, and the duration of each experiment, were as follow:—

20 cows, in two lots of 10 each	10 weeks.
20 oxen, in two lots of 10 each	20 „
60 sheep, in five lots of 12 each	20 „
48 pigs, in six lots of 8 each	10 „

The following is the description of the plan and results of each set of experiments.

1. *The Experiments with Milking Cows.*

Application being made to James Archibald Campbell, Esquire, of Rugby, he kindly placed his numerous herd of milking cows at disposal for the purposes of this experiment, and allowed it to be conducted in his byres, at Newlands Farm, near the town.

Two lots of 10 each having been selected, weighed, and placed apart December 1863, all received for a preliminary period of about a fortnight (during which time the milk was daily weighed) exactly the same description and amount of food, consisting of 5 lbs. rape cake and 2 lbs. bean-meal per head per day, and a mixture of clover-chaff, straw-chaff, and swedes, which averaged, of clover-chaff about 14 lbs., of straw-chaff between 7 and 8 lbs., and of swedes about 50 lbs. per head per day. The swedes were pulped, mixed with the clover and straw-chaff, the mixture slightly heated by fermentation, sprinkled with water, the meal then added, and the allowance given in three feeds daily.

On December 21, 1863, the animals were re-weighed, and with a view to greater equality in the lots, some few changes in the allotment were made; the exact experiment was then commenced, and it was continued for 10 weeks, to February 29, 1864. Both lots continued to receive the same food as previously,

excepting that Lot 1 had 3 lbs. of rape cake (per head per day), replaced by 3 lbs. of barley No. 1, and Lot 2. had 3lbs. of cake replaced by the amount of malt and malt-dust produced from 3 lbs. of barley No. 1.

The milk of each cow was weighed morning and afternoon daily. A mixed sample of the milk of each lot was tested once a week, morning and afternoon, by the lactometer; and the animals themselves were weighed at the beginning, and at the end of the fourth, eighth, and tenth weeks.

The results of all the weighings, both of the milk and of the cows, are recorded in detail in Tables X.-XIX., pp. 68-87 in the Appendix; those obtained on testing the milk in Table XX. p. 88; and the results relating both to the food consumed and to the weights, the increase in live weight, and the milk yielded, during the first four, the second four, the last two weeks, and the total period of the experiment, are given in Tables XXI.-XXIV., pp. 89-92, also in the Appendix.

The results relating to the whole period of 10 weeks are summarized in Table X., which now follows, and with slight reference to the details in the Appendix the figures there given will bring to view most of the points to which it will be necessary here to call attention.

It should be particularly observed, that in all the tables relating to these new experiments—whether with cows, oxen, sheep, or pigs, and both in the Appendix and in the body of the Report—the figures represent, wherever malt was given, not the actual weight of malt and malt-dust consumed, but the weight of barley from which (according to Table IV. p. 16) they would be produced.

In the experiments with cows it was designed to give to one lot an uniform amount of barley per head per day throughout the whole period, and to the other, also uniformly throughout the period, exactly as much malt and malt-dust as was produced from that amount of barley. Owing, however, to the gain of weight of the kiln-dried malt and dust by the absorption of moisture as the feeding experiment proceeded, some modification in the actual amounts given had to be made from time to time by way of compensation, and it was found by careful calculation at the conclusion that the malt-fed cows had in fact consumed somewhat less than the allotted amount when reckoned in the condition of dryness in which the produced malt was weighed, sampled, and its relation to the raw barley settled as in Table IV. p. 16. The slight irregularities in the actual weights given at the different periods as here explained are not recognised in the tables, but the total quantities consumed are equalized over the several periods. Due correction is, however, made for the slight deficiency in the total consumption of the

…eight, and Milk.

	Total in Ten Weeks.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.	To produce 100 lbs. Milk.	Cows.	Weights. At Commencement.	Weights. At Conclusion.	Increase in Live-weight. Total in Ten Weeks.	Increase in Live-weight. Per 1000 lbs. Live-weight per week.	Milk yielded. Total in Ten Weeks.	Milk yielded. Per Head per Day.	Milk yielded. Per 1000 lbs. Live-weight per Week.
Lot 1.—10 Cows; Special Food—Unmalted Barley.												
	Lbs.	Lbs.	Lbs.	Lbs.	Nos.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Barley, unmalted	2,100	3·0	18·4	12·6	1	1,086	1,136	50	6·17	1,311	18·7	146
Rape Cake	1,400	2 0	12·3	8 4	2	1,044	1,114	70		2,191¼	31·3	
Bean-Meal	1,400	2·0	12 3	8·4	3	1,065	1,150	85		1,757¾	25·1	
Clover-Chaff	9,800	14·0	85·9	58·8	4	1,082	1,150	68		1,540¾	22·0	
Straw-Chaff	5,390	7 7	47·3	32·3	5	1,020	1,018	—2		1,756	25·1	
Pulped Swedes	35,280	50·4	309·2	211 7	6	1,164	1,312	148		1,425	20·4	
					7	1,260	1,308	48		1,450	20·7	
					8	944	974	30		1,626½	23 3	
					9	1,156	1,252	96		1,302	18 6	
					10	1,236	1,347	111		2,307¼	32·9	
					Totals	11,057	11,761	704	..	16,667½	..	..
					Averages	1,106	1,176	70	6·17	1,666¾	23·8	146
Lot 2.—10 Cows; Special Food—Malted Barley (with Malt-dust).												
	Lbs.	Lbs.	Lbs.	Lbs.	Nos.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Barley, malted (with its dust).	2,072*	3 0*	18·2*	13·3*	1	1,184	1,310	126	6·28	1,065¾	15·3	137¾
Rape Cake	1,400	2·0	12·3	9·0	2	992	1,022	30		1,901¼	27·2	
Bean-Meal	1,400	2·0	12 3	9·0	3	1,260	1,428	168		459¾	6·6	
Clover-Chaff	9,800	14 0	86·2	62·8	4	1,020	1,066	46		1,460¼	20·9	
Straw-Chaff	5,390	7·7	47 4	34·6	5	914	936	22		1,520¾	21·7	
Pulped Swedes	35,280	50·4	310·4	226·9	6	1,316	1,396	80		1,618	23·1	
					7	1,008	1,076	68		1,841	26·3	
					8	1,065	1,179	114		1,512¼	21·6	
					9	1,040	1,092	52		1,995¾	28·5	
					10	1,206	1,214	8		2,225¾	31·8	
					Totals	11,005	11,719	714	..	15,600¼	..	..
					Averages	1,101	1,172	71	6·28	1,560	22 3	137¾

* These figures represent, not the actual weights of malt [redacted] malt-dust, but the weight of the barley from which they would be produced.

malt and dust. Thus, as the tables show, the 10 malt-fed c consumed in the 10 weeks malt and dust equivalent to 2072 of barley, whereas they should have consumed the amount p duced from 2100 lbs. of barley, a difference which it will admitted is of little or no practical importance.

The first point to remark in regard to the results obtained w the cows is, that the barley, or the malt, constituted a c paratively small proportion of the total food consumed; certa by no means enough to nauseate or disturb the digestion by vi of the amount of sugar supplied when malt was given, but, the other hand, fully sufficient to increase the digestibility of associated food materials, provided, as has been assumed, it p duces that effect by virtue of its property of aiding the conv sion of their starch into the more soluble conditions of dextri and sugar.

According to the figures in the tables the 10 barley-fed co gave, during the first period of four weeks, rather less increase live-weight, but rather more milk, and consumed rather l food to produce a given amount of milk, than the 10 malt-f cows; and during the second period of four, and the third peri of two weeks, they gave rather more both of increase and milk, and consumed rather less food to produce a given amou of milk.

Taking the whole period of 10 weeks the 10 barley-fed co gave 10 lbs. less increase in live-weight, but 1,067 lbs. (m than 100 gallons) more milk, and consumed less of every descr tion of food for the production of 100 lbs. of milk than the malt-fed cows. It should be observed, however, that one of malt-fed animals (No. 3), being in calf, increased in live-wei very considerably, and fell off very much in yield of milk, giving one third the average total amount of the rest, and that her increase, yield of milk, and proportionate amount of food, excluded by calculation (which is perhaps the fairer cours there would then be rather less increase, but rather more m yielded, both per head and per 1000 lbs. live-weight per we and slightly less food consumed to produce a given amount milk by the malt-fed than by the barley-fed cows.

Thus, taken in the one way the results are in favour of unmalted, and in the other of the malted grain. But a car consideration of the facts will lead to the conclusion that effects were so nearly equal as not to indicate any decided adv tage of either over the other; and if there be no deci advantage from the use of a given amount of malted grain o that from the use of the amount of raw grain from which would be produced, the economical advantage is of course w the unmalted, on account of the cost of the malting process.

On testing the milk of each lot of cows once a week, morning and afternoon, by the lactometer, that from the barley-fed animals invariably showed the higher proportion of cream, which again throws the balance somewhat in favour of the unmalted grain.

2. *The Experiments with fattening Oxen.*

These experiments, as well as those with sheep and pigs, were conducted at Rothamsted, Herts. Twenty-two three-year old polled Scots were purchased, and for about a fortnight the whole were turned out to graze during the day, and were brought into the yards at night, and supplied with clover-chaff and swedes *ad libitum*. They were then, on November 28, 1863, all weighed, two were thrown out, and the remainder were divided into two lots of 10 each, by selecting two as nearly alike as possible taking one for each lot, and so on, giving apparently the best first to one lot and then to the other, until the whole 20 were divided. The two lots were then put, two and two, into separate compartments (each communicating with an open yard) of a shed in which the experiment was to be conducted, and they were all fed for a few days longer on clover-chaff and swedes, *ad libitum*.

On December 1, 1863, the animals were re-weighed, the exact experiment was then commenced, and it was continued for 20 weeks, to April 19, 1864.

During the whole of the 20 weeks Lot 1 had 4 lbs. of barley "No. 2" per head per day, and Lot 2 the amount of malt and malt-dust produced from 4 lbs. of barley "No. 2." The barley and malt were crushed. Each lot had, besides, during the first four weeks 8 lbs. of clover-chaff, during the second four weeks 10 lbs. of clover-chaff, during the next eight weeks 2 lbs. of oil-cake and 12 lbs. of clover-chaff, and during the last four weeks 4 lbs. of oilcake and 12 lbs. of clover-chaff, per head per day; also cut swedes, *ad libitum* (but weighed), throughout the whole 20 weeks. The oxen themselves were weighed every four weeks. At the conclusion of the experiment they were killed, and the weights of the carcasses, &c., ascertained.

The details of the food consumed, of the weights, and of the increase in live-weight, during each of the five periods of four weeks each, are recorded in the five Tables XXV.—XXIX., pp. 93—97, in the Appendix; the particulars relating to the weights and increase during each separate and the total period are summarised in Table XXX., p. 98; those relating to the food consumed and increase yielded in Table XXXI., p. 99; and those relating to the dead weights in Tables XXXII. and XXXIII., pp. 100, 101, also in the Appendix.

The results for the whole period of 20 weeks of feeding are further conveniently summarised in Table XI., which now follows:

Table XI.—Results obtained with Oxen, on Barley and Malt "No. 2."

Period of Experiment 20 Weeks; from December 1, 1863, to April 19, 1864.

	Food consumed.				Oxen.	Weights, and Increase in Live-weight.				
						Weights.		Increase in Live-weight.		
	Total in 20 Weeks.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		At Commencement.	At Conclusion.	Total in 20 Weeks.	Per Head per Week.	Per 1000 lbs. Live-weight per Week.
Lot 1.—10 Oxen; Special Food—Unmalted Barley.										
					Nos.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
					1	1,151	1,404	253	12·7	
					2	1,079	1,386	307	15·4	
	Lbs.	Lbs.	Lbs.	Lbs.	3	1,183	1,591	408	20·4	
Barley, unmalted	6,600	4·0	22·2	165·1	4	1,097	1,404	307	15·4	
Oilcake	2,240	1·6	8·9	66·0	5	1,095	1,422	327	16·4	13½
Clover-chaff	15,120	10·8	59·9	445·6	6	1,039	1,344	305	15·3	
Roots,* ad lib.	106,148	77·2	428·6	3157·3	7	1,152	1,566	414	20·7	
					8	1,015	1,424	409	20·5	
					9	1,102	1,482	380	19·0	
					10	1,008	1,291	283	14·2	
					Totals	10,921	14,314	3,393	..	..
					Averages	1,092	1,431	339½	17·0	13½
Lot 2.—10 Oxen; Special Food—Malted Barley (with Malt-dust).										
					No.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
					1	1,204	1,525	321	16·1	
					2	1,057	1,422	365	18·3	
	Lbs.	Lbs.	Lbs.	Lbs.	3	1,148	1,525	377	18·9	
Barley, malted with its dust	6,600†	4·0†	22·5†	187·6†	4	1,088	1,396	308	15·4	
Oilcake	2,240	1·6	9·0	75·0	5	1,176	1,444	268	13·4	12
Clover-chaff	15,120	10·8	60·7	506·5	6	1,092	1,256	164	8·2	
Roots,* ad lib.	108,905	77·8	437·4	3645·4	7	1,078	1,346	268	13·4	
					8	1,029	1,252	223	11·2	
					9	1,078	1,385	307	15·4	
					10	1,008	1,392	384	19·2	
					Totals	[illegible]	[illegible]	[illegible]		

s in the case of the cows, so in that of the oxen (and indeed ıe sheep also), some allowance was made during the course he experiment to compensate for the progressive gain of sture by the malt; but in the tables no account is taken he extra weight given for this purpose, the figures there ın representing the quantities of the malt reckoned in the of dryness in which it was originally sampled and allotted, total quantity consumed being equalized over the several ods, as was in reality very nearly the case.

ıs already stated the quantity of malt and dust given per l per day to the malt-fed oxen was that which would be luced from 4 lbs. of barley. This, though not enough to ıeate, was more than enough on the assumption of its acting ıiding the digestion of other food, and it was also quite as h as would ordinarily be given of any cereal grain, it being ittedly preferable to give a mixed food, including such ers as cake or pulse.

ittle need be said on the progress of the animals during each rate monthly period. As is always the case, it varied iderably among the individuals of each lot; though the ıge increase per head was, with each lot, comparatively rm during each of the first three months; with both, and nost with Lot 1 having the barley, it fell off considerably ıg the fourth period, owing, it was believed, to deterioration ıe swedes, but with both it recovered considerably, more ially with Lot 1, during the last month, when the roots ı consisted in part of mangolds.

irecting attention to the total and average results over the e period, as given in Table XI., it is worthy of remark although the roots were given *ad libitum*, the two lots con-d in the 20 weeks within 7 cwts. of the same amount; the nalt-fed oxen taking about that amount more than the 10 y-fed ones. The fact is, that, if not the actual weight of consumed, but, as in the Table, the amount of barley from h it would be produced be reckoned against the malt-fed als, more food was expended upon them per 1,000 lbs. live-ıt per week, that is in relation to a given live-weight n a given time, than upon the others; though in reality received even slightly less solid matter, that is, reckoning ıalt as such instead of as representing so much barley.

th lots of oxen gave more than an average amount of ase, whether reckoned in proportion to a given live-weight ın a given time, or to a given amount of food consumed; the 10 having the unmalted barley gave during the 20 ss 408 lbs. more increase in live-weight than those having qual amount of the same barley malted. The result was,

D 2

that, whether only the actual weight of malt, or the weigh barley from which it would be produced, be reckoned aga the malt-fed oxen, they required more total food, and more dry substance of food, to produce a given amount of increas live-weight than the barley-fed oxen.

The difference in the amount of increase produced fro given amount of food in the two cases was indeed not great, such as it was it was unfavourable to the malted grain; an may be observed that, on several occasions during the cours the experiments, experienced breeders and feeders who inspe the animals, whilst approving of the selection and allotn expressed a decided opinion in favour of the appearance handling of the barley-fed oxen, and frequently so in opposi to their own preconceived views on the subject.

At the conclusion of the 20 weeks of feeding the beasts only moderately fat; but as it was desirable to close the ex ment then, they were at once sent to the butcher, in ord possible, to gain further information as to the compar character and ripeness of the two lots than that afforded by increase in live-weight alone.

Mr. Slater, of Kensington, who purchased the whole, good enough to afford every facility for weighing the se parts of each animal as might be desired, and also favoure with his opinion of the quality of the meat.

The feeding experiment was concluded on April 19, 1 The first five of the barley-fed oxen were killed on April the first five of the malt-fed on April 21, the second five of barley-fed on April 22, and the second five of the malt-fe April 23.

The actual weights of the animals, and of some of separated parts, are recorded in Table XXXII., and the pro tion of the carcass, and of the several offal parts, in 100 weight, in Table XXXIII., in the Appendix.

The per-centage of the dead or carcass weight to the weight of each animal—the most important item to consid is given in Table XII., which now follows :—(See next pag

The proportion of dead or carcass weight to live-weigh was to be expected, ranged rather low throughout; but it on the average, and pretty uniformly with each pair of ani in favour of the barley-fed over the malt-fed oxen.

Mr. Slater's report on the meat of the different lots was, the beef of one (No. 3) of the first five of the barley-fed was very good, but that that of the remaining four was of useful quality, and cut too pale in the lean; and that that o second five of the same lot was not quite so good; that the of the first five of the malt-fed animals cut a very good c

TABLE XII.—PER-CENTAGES of DEAD OR CARCASS WEIGHTS (cold) in UNFASTED LIVE-WEIGHTS.

OXEN.

Nos.	Per Cent. Carcass in unfasted Live-weight.	
	Lot 1. Unmalted Barley (No. 2).	Lot 2. Malted Barley (No. 2).
1	53·6	51·1
2	58·0	56·4
3	57·7	53·0
4	57·7	56·0
5	56·5	57·1
6	55·7	55·3
7	54·8	53·1
8	56·5	57·7
9	58·3	56·0
10	57·6	56·6
Mean	56·6	55·6

both in the fat and the lean, and was decidedly preferable to that of the first five of the barley-fed, but that the carcasses of the other five of the malt-fed oxen were very indifferent in point of ripeness; indeed, he concluded that all required six weeks or two months more feeding to rank as first quality beef.

The result was, then, that none of the oxen were ripe enough; that the barley-fed animals were the most even in condition and quality; but that among the malt-fed ones the beef of some was decidedly superior, and that of others decidedly inferior, to that of any of the barley-fed animals. From this it would seem as if the result had been more influenced by the constitution and condition of the individual animals in the case of the malt than of the barley-fed oxen; and it is worthy of remark that of the 10 malt-fed ones it was the five that were the heaviest, and in the best condition at the commencement, and not the more backward or weakly animals, that gave the best result upon the malt diet.

To conclude, the results of the experiments with oxen may be briefly summarised as follows:—the barley-fed animals gave slightly more increase in live-weight, and a slightly higher proportion of dead-weight to live-weight than the malt-fed ones; none were fully ripe; the progress and condition of the barley-fed oxen were the more uniform, but some of the malt-fed were in better and others in worse condition than any of the barley-fed animals.

3. *The Experiments with fattening Sheep.*

From a flock of about 90 Down Wethers, about 10 months old, five lots of 12 each were selected by picking out five of nearly equal weight and character, allotting one for each pen, and so on until there were 12 in each. Each of the lots was put into a separate compartment, on rafters, under cover. For a preliminary period of about a fortnight all were fed alike on about ¾ lb. cotton cake, and ¾ lb. clover-chaff, per head per day, with cut swedes *ad libitum.*

On December 2, 1863, all were re-weighed, and the exact experiment was then commenced. From that date, for 20 weeks (to April 20, 1864), all had 1 lb. of clover-chaff per head per day, and cut swedes (or mangolds) *ad libitum;* and the respective lots had, besides, as their special food, unmalted or malted barley, as under:—

Lot 1. Unmalted barley No. 1; for 16 weeks ¾ lb., and for the remaining four weeks 1 lb. per head per day.

Lot 2. Malt and malt-dust from barley No. 1; for 16 weeks an amount per head per day equal to that produced from ¾ lb., and for the remaining four weeks an amount equal to that produced from 1 lb. of the barley.

Lot 3. Unmalted barley No. 2; for 16 weeks ¾ lb., and for the remaining four weeks 1 lb. per head per day.

Lot 4. Malt and malt-dust from barley No. 2; for 16 weeks an amount per head per day equal to that produced from ¾ lb., and for the remaining four weeks an amount equal to that produced from 1 lb. of the barley.

Lot 5. A mixture of two parts unmalted barley No. 2, and of the malt and dust from one part of barley No. 2; for 16 weeks an amount of the mixture per head per day representing ¾ lb., and for the remaining four weeks an amount representing 1 lb. of the barley.

Both barley and malt were crushed. The sheep were weighed every four weeks; and at the conclusion of the 20 weeks they were all killed, and the weights of their carcasses, &c., ascertained.

The results relating to each of the five separate periods of four weeks each are recorded in the five Tables XXXIV.-XXXVIII. respectively; a summary of the weights, and of the increase during each and the total period, is given in Table XXXIX., and a summary relating to both food and increase in Table XL., all in the Appendix (pp. 102-115).

The results relating to the whole period of 20 weeks are summarised in Tables XIII. and XIV., which now follow. (See pp. 40, 41.)

From the plan given above it will be seen that these experiments with sheep comprised three directly comparative trials:—

1. Between Lot 1, with a given amount of barley No. 1, and Lot 2, with an equal amount of the same barley malted.
2. Between Lot 3, with a given amount of the feeding-barley No. 2, and Lot 4, with an equal amount of the same barley malted.
3. Between Lot 3, with a given amount of barley No. 2, and Lot 5, with an equal amount of the same barley, two-thirds unmalted and one-third malted.

The only deviation from this plan was, as found by calculation at the conclusion of the experiment, that Lot 2 had, during the 20 weeks, received malt equal to only 1326, instead of 1344 lbs. of barley; that is, 18 lbs. = 1½ lb. per head too little, which, spread over 20 weeks, would be of no consequence, and was partly compensated by the extra amount of swedes consumed.

The tables of detail (in the Appendix) show that all five lots gave more increase in live-weight during the first than during any of the subsequent monthly periods; and they pretty uniformly gave the least in the fourth month, when the swedes were failing; nor did they give much more in the fifth and last month, when the allowance of barley and malt were increased. But, as will be afterwards seen, the sheep were very fairly ripe, and as fattening animals approach that condition they do not show so much increase in live-weight in proportion to their real progress in accumulation of solid matter as in the earlier stages of feeding. There was, moreover, considerable variation in the rate and amount of increase among the individual animals of each lot, but by no means more than is usual when as many as a dozen animals are fed together on the same food. In fact, the average result obtained from the twelve animals in each case, and each fed for a period of 20 weeks (*see* Tables XIII. and XIV.), may be taken as very fairly indicating the comparative qualities of the different foods.

All five lots of sheep gave about an average amount of increase, reckoned both in relation to a given live-weight within a given time, and to the amount of food consumed.

The amount of malt given in experiments 2 and 4, represented three times as much barley as that given in the malted state in experiment 5, and constituted a much larger proportion of the total food than in the case of either the cows or the oxen.

There was, however, apparently no advantage gained from the

Table XIII.—Results obtained with Sheep, on Barley and Malt "No. 1."

Period of Experiment 20 weeks: from December 2, 1863, to April 20, 1864.

	Food consumed.				Sheep.	Weights, and Increase in Live-weight.				
						Weights.		Increase in Live-weight.		
	Total in 20 Weeks.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		At Commencement.	At Conclusion.	Total in 20 Weeks.	Per Head per Week.	Per 100 lbs. Live-weight per Week.
Lot 1.—12 Sheep; Special Food—Unmalted Barley.										
	lbs.	lbs.	lbs.	lbs.	Nos.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Barley, unmalted	1,344	0·75	4·62	269·9	1	112	142	30	1·50	
Clover-chaff	1,680	1·0	5·77	337·3	2	101	150	49	2·45	
Roots,* ad lib.	18,595	11·1	63·86	3733·9	3	101	164	63	2·65	
					4	107	137	30	1·50	
					5	100	140	40	2·00	
					6	92	134	42	2·10	1·71
					7	100	140	40	2·00	
					8	105	162	57	2·85	
					9	88	133	45	2·25	
					10	119	161	42	2·10	
					11	88	119	31	1·55	
					12	94	133	39	1·95	
					Totals.	1,207	1,705	498	..	..
					Averages.	101	142	41½	2·08	1·71
Lot 2.—12 Sheep; Special food—Malted Barley (with Malt-dust).										
	Lbs.	Lbs.	Lbs.	Lbs.	Nos.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Barley, malted, with its dust	1,326†	0·76†	4·54†	263·1†	1	109	154	45	2·25	
Clover-chaff	1,680	1·0	5·75	333·3	2	94	136	42	2·10	
Roots,* ad lib.	18,688	11·1	63·96	3707·9	3	96	136	40	2·00	
					4	100	140	40	2·00	
					5	119	171	52	2·60	
					6	112	161	49	2·45	1·72
					7	94	126	32	1·60	
					8	102	137	35	1·75	
					9	105	160	55	2·75	
					10	94	128	34	1·70	
					11	96	140	44	2·20	
					12	88	124	36	1·80	

ABLE XIV.—RESULTS obtained with SHEEP, on BARLEY and MALT "No. 2."

Period of Experiment 20 weeks; from December 2, 1863, to April 20, 1864.

	Food consumed.				Sheep.	Weights, and Increase in Live-weight.				
						Weights.		Increase in Live-weight.		
	Total in 20 Weeks.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		At Commencement.	At Conclusion.	Total in 20 Weeks.	Per Head per Week.	Per 100 lbs. Live-weight per Week.
Lot 3.—12 Sheep; Special Food—Unmalted Barley.										
	Lbs.	Lbs.	Lbs.	Lbs.	Nos.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
					1	112	163	51	2·55	
					2	112	158	46	2·30	
					3	114	150	36	1·80	
alted . .	1,344	0·75	4·61	267·2	4	105	147	42	2·10	
					5	105	164	59	2·95	
. . . .	1,680	1·0	5·76	334·0	6	94	120	26	1·30	1·73
					7	98	117	19	0·95	
lb. . . .	18,712	11·1	64·19	3720·1	8	84	120	36	1·80	
					9	104	140	36	1·80	
					10	104	152	48	2·40	
					11	88	142	54	2·70	
					12	96	136	40	2·00	
					Totals .	1·208	1,709	503	..	..
					Averages	100	142	42	2·10	1·73
Lot 4.—12 Sheep; Special Food—Malted Barley (with malt-dust).										
					Nos.	Lbs.	Lbs.	Lbs.	[illegible]	Lbs.
					1	119	150	31	1·55	
	Lbs.	Lbs.	Lbs.	Lbs.	2	114	164	50	2·50	
					3	94	134	40	2·00	
ted, with	1,232†	0·75†	4·61†	275·0†	4‡	(102)	(95)	(—7)	—	
					5	108	157	49	2·45	
. . . .	1,640	1·0	5·77	343·9	6	91	128	37	1·85	1·68
					7	107	144	37	1·85	
lb. . . .	16,854	10·9	63·12	3762·1	8	91	140	49	2·45	
					9	102	140	38	1·90	
					10	94	126	32	1·60	
					11	100	146	46	2·30	
					12	91	130	39	1·95	
					Totals .	1,111	1,559	448	..	..
					Averages	101	142	40¾	2·04	1·68
Lot 5.—12 Sheep; Special Food—Unmalted and Malted Barley (with malt-dust).										
					Nos.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
					1	128	166	38	1·90	
					2	114	126	12	0·60	
	Lbs.	Lbs.	Lbs.	Lbs.	3	91	130	39	1·95	
alted . .	896	0·5	3·14	188·6	4	104	142	38	1·90	
					5	94	140	46	2·30	
ted, with . . .	448†	0·25†	1·57†	94·3†	6	96	145	49	2·45	1·66
					7	94	136	42	2·10	
. . . .	1,680	1·0	5·88	353·7	8	102	146	44	2·20	
					9	91	134	43	2·15	
lb. . . .	18,598	11·1	66·10	3915·4	10	98	133	35	1·75	
					11	88	116	28	1·40	
					12	91	132	41	2·05	
					Totals .	1,191	1,666	475	..	..
					Averages	99	139	39¾	1·98	1·66

s the first four months; about one-fourth swedes and three-fourths mangolds the last month.
figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which they duced.
heep of this lot was killed 63 days after the commencement of the experiment, and its weights, and the pro- ount of food, are excluded.

larger proportion of malt in the food; for, although th
gave about an average, the oxen gave more than an
amount of increase.

There was, too, with the sheep, as with the oxen, compa
little difference in the result obtained with the unmal
malted grain. But such as it was it was more in favou
unmalted than of the malted barley. Thus, in the com
experiment with barley No. 1 (Lot 1 unmalted and Lot 2
there was slightly more average increase per head, and,
reckoning only the actual weight of the malt consumed
amount of barley from which it would be produced, aga
animals, there was slightly less both of fresh food and o
solid matter of food consumed to produce a given am
increase with the malted barley. But in the similar com
experiment with barley No. 2 (Lot 3 unmalted and Lot 4
the average increase per head was in a somewhat greate
in favour of the unmalted, and there was also with it le
expended for the production of a given amount of increase.
was, too, somewhat less average increase per head, and
larger quantity of food required to produce a given am
increase, when two-thirds of the barley was unmalted a
third malted (Lot 5) than when an equal amount of t
barley was given entirely unmalted (Lot 3). There were,
both a less average increase per head, and a greater am
food required to produce a given amount of increase wh
one-third (Lot 5), than where the whole of the barley (Lot
malted; still, the fact is that, in both respects, both l
malted barley (4 and 5) gave worse results than Lot 3, wh
the same description of barley entirely unmalted.

With sheep, therefore, as with oxen, there was, upon th
less food expended to produce a given amount of increase
weight when unmalted than when a corresponding am
malted barley was given. The differences were, inde
slight, but the economical advantage is, of course, more i
of the unmalted grain than the figures show, when the cos
malting process is taken into the calculation.

At the conclusion of the feeding experiment all five
sheep were sold to Mr. Slater, and they were all killed
few days of each other. The feeding experiment en
April 20. On April 21 five of Lot 1, five of Lot 2, an
Lot 3, were killed; on April 22 six of Lot 4, six of Lo
one each of Lots 1, 2, and 3, were killed; and on April
remaining six of Lot 1, six of Lot 2, six of Lot 3, five o
and six of Lot 5, were killed.

The actual dead weights are recorded in Table XLI.,
per-centages of the carcasses and other parts, in the live-
in Table XLII., pp. 116-119, in the Appendix.

In the following Table (XV.) are summarised the per-centages the dead or carcass weights in the unfasted live-weights of the eep of each lot:—

TABLE XV.—PER-CENTAGES OF DEAD OR CARCASS WEIGHTS (cold) in UNFASTED LIVE-WEIGHTS.

SHEEP.

Sheep.	Lot 1.	Lot. 2.	Lot 3.	Lot 4.	Lot 5.
	Barley No. 1.		Barley No. 2.		
Nos.	Unmalted.	Malted.	Unmalted.	Malted.	½ Unmalted, ½ Malted.
1	51·4	52·0	53·4	48·7	52·2
2	49·3	47·8	51·3	48·8	52·4
3	51·3	50·0	56·0	50·8	51·5
4	53·3	51·4	55·1	*	50·7
5	49·3	52·6	51·8	51·6	47·1
6	47·8	47·2	54·6	51·6	51·7
7	52·9	54·0	54·7	49·3	50·7
8	51·9	54·0	52·5	49·3	54·1
9	54·9	53·1	54·3	52·9	52·2
10	50·9	50·8	50·0	55·6	49·6
11	50·4	53·6	50·0	51·4	50·0
12	55·6	51·6	53·2	51·5	52·3
Means ..	51·6	51·5	53·1	51·0	51·2

The sheep being sold and killed without being shorn, their e-weights of course included the wool, and hence the low proportion of dead or carcass weight to live-weight in all cases. Nor is the average proportion very different with the different lots. Such as it was, however, it was slightly in favour of the unmalted rley. The highest proportion was given by Lot 3 fed on the malted barley No. 2. That barley, indeed, contained, as will remembered, considerably the higher per-centage of nitrogen, d was doubtless of very good feeding quality, though much ferior to the other for the manufacture of malt for brewing irposes.

Mr. Slater reported that all the sheep were very good both as garded size and quality; and he did not see reason to draw any stinction between the different lots further than was indicated y the weights.

Upon the whole the experiments with sheep showed very little ifference between the effects of a given amount of barley, and of ae malt and malt-dust produced from an equal weight of the

* No. 4. Sheep of this lot was killed 63 days after the commencement of the experiment.

same barley. Such as it was the advantage was with the u malted barley, both in regard to the amount of increase in liv weight obtained, and to the proportion of dead-weight to liv weight.

4. *The Experiments with fattening Pigs.*

Fifty-two pigs were purchased for the purpose of the expe ments, and all were fed for a preliminary period of about a fo night on a mixture of equal parts barley-meal and bran, given *libitum.* They were then weighed, and six lots, of eight eac were selected, in the same manner as for the sheep, and all aga fed for a few days on the same mixture of barley-meal and bra

On December 24, 1863, all were re-weighed, and the ex experiment was commenced, and it was continued for 10 wee to March 3, 1864. Throughout the whole period all had 1 of pea-meal per head per day, and the respective lots had, addition, special food, as under:—

Lot 1. Unmalted barley No. 1, *ad libitum.*
Lot 2. The malt (with its dust) from barley No. 1, *ad libit*
Lot 3. Unmalted barley No. 1, and the malt (with its du from barley No. 1, each separately, *ad libitum.*
Lot 4. Unmalted barley No. 2, *ad libitum.*
Lot 5. The malt (with its dust) from barley No. 2, *ad libitu*
Lot 6. A mixture of four parts unmalted barley No. 2 wi the malt and malt-dust from one part of barley No. *ad libitum.*

The barley and the malt were each coarsely ground; an enough to last for several days being weighed out for each lot, i was mixed with water, and so given as needed. The daily allow ance of pea-meal was mixed with a portion of the other food The animals were weighed fortnightly, and at the conclusion o the 10 weeks they were all killed, and the weights of their car casses ascertained.

Barley-meal, with or without a small proportion of pea-mea is recognised as perhaps the most appropriate fattening food o the pig. Such a diet contains a very much larger proportion o starch than that of either cows, oxen, or sheep; and if malt give as food acted in any material or striking degree by reason of it own remaining starch, or that of accompanying food, becomin more readily digestible and assimilable, it might be assumed th it would be particularly advantageous in the characteristicall starchy food of the fattening pig.

Analysis has shown that kiln-dried malt may contain near two-thirds its weight of unaltered starch and starch changed onl into the more soluble form of dextrine, and not more than fro

10 to 12 per cent. of ready-formed sugar. The question arises, what proportion of the food, to act the most advantageously, should consist of malted grain, provided it were advantageous to employ it at all?

Considering that so small a proportion of the starch of raw barley is converted into sugar by malting, it seemed desirable, at any rate in some of the experiments, to give nearly the whole of the meal in the state of malt, and in others to give much less, in admixture with a considerable amount of raw grain, or other starchy food. Accordingly, as shown by the plan of the experiments with pigs, given above, beside the 1 lb. of pea-meal given per head per day to each lot of pigs, Lot 1 had barley No. 1, *ad libitum*, and Lot 2 the malt (and dust) from the same barley, *ad libitum;* thus substituting the whole of the unmalted grain of Lot 1 by malted grain, whilst the animals of Lot 3 were allowed to take of the unmalted or the malted grain at pleasure. Again, Lot 4 had barley No. 2, *ad libitum;* Lot 5 the malt (and dust) from barley No. 2, *ad libitum;* and Lot 6 a mixture of four-fifths unmalted and one-fifth malted barley No. 2, *ad libitum*.

The result of this arrangement was, that in the cases of Lots 2 and 5, the one with the first and the other with the second quality malt, *ad libitum*, the malt contributed from 85 to 90 per cent. of the total dry or solid matter consumed; that in experiment 3, in which the pigs took the unmalted or the malted grain at pleasure, the dry or solid matter of the malt consumed amounted, taking the average of the whole period, to only about 13 per cent. of the total solid matter of the food; and that in experiment 6, in which only one-fifth of the barley was given in the malted state, the malt contributed only between 16 and 17 per cent. of the dry or solid substance consumed.

For the sake of comparison with the above statements, it may be observed that in the experiment with cows the malt contributed only about 7½, in that with oxen between 13 and 14, in experiments 2 and 4 with sheep between 22 and 23, and in experiment 5 with sheep only about 7¼ per cent. of the total solid matter of the food consumed. Taking all the experiments together, therefore, the proportion of the total food given as malted grain varied very considerably, contributing in several cases only from 7 to 8, and in others nearly 90 per cent. of the total solid substance of the food of the animals.

It may be further remarked on this point, that although taking the average of the whole period the pigs of Lot 3, which settled for themselves the proportion of malt in their food, took only about 13 per cent. of the total solid substance in the form of malt, yet during the first fortnight they took 31¾, during the

second 19½, during the third only 3½, during the four
during the fifth 6½ per cent., giving over the total
10 weeks the average of about 13 per cent., as above st
would thus appear that, pig-like, they took of the swe
grain to nauseation at first; they then reduced their con
of it to a minimum, and afterwards gradually increase
slight degree.

The details of the feeding experiments with pigs are
Tables XLIII.-XLIX., and those relating to their dea
in Tables L.-LI. in the Appendix, pp. 120-137.

The results of the feeding experiments are summ
Tables XVI. and XVII., which now follow. (See pp.

Leaving the details given in the Appendix for ref
will suffice to call attention here to the average results
over the total period of ten weeks in each experiment.

The pigs of Lots 1, 3, 4, and 6, which, besides th
pea-meal per head per day given to all, had, as their a
food, either unmalted barley entirely, or only a small p
of malted barley, gave fully an average amount of incr
in relation to their weight within a given time an
amount of food consumed. Those of Lots 2 and 5, on
hand, which had as their additional food malted barley
gave a defective result in both respects; those of Lot
the malt from the barley No. 1, being the worst.

There is no doubt that in the two last-mentioned ex
(2 and 5), the proportion of saccharine matter in the
was unnaturally large. It was probably somewhat so i
ment 6, in which the additional food consisted of f
unmalted barley and the malt and dust from one part o
for when, as in experiment 3, the unmalted and malte
were each given separately, *ad libitum*, although at
animals took more than one-third from the malted, th
very much in their consumption of it, until, averaged
whole ten weeks of the experiment, they had not ta
one-sixth in the malted state. Even, however, in the
in which not more than one-fifth or one-sixth of the
food, or not more than one-sixth or one-seventh of the
was in the form of malted barley, rather more food was
to produce a given amount of increase than when the
the additional food was unmalted barley.

The pigs were not sent to London, but were sold a
in the neighbourhood. The animals of pens 1, 2, 4, a
killed in the evening of March 3, the feeding experime
concluded, and the last live-weights having been take
morning of that day; but the pigs of pen 6 were not ki
March 7, nor those of pen 3 until March 9, so tha

Table XVI.—Results obtained with Pigs, on Barley and Malt "No 1."

Period of Experiment 10 weeks; from December 24, 1863, to March 3, 1864.

	Food consumed.				Pigs.	Weights, and Increase in Live-weight.				
						Weights.		Increase in Live-weight.		
	Total in 10 Weeks.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		At Commencement.	At Conclusion.	Total in 10 Weeks.	Per Head per Week.	Per 100 lbs. Live-weight per Week.
Lot 1.—8 Pigs; Food—Pea-meal, and Unmalted Barley.										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	158	287	129	12·9	
					2	160	336	176	17·6	
eal . . .	560	1·00	3·4	47·6	3	133	264	131	13·1	
					4	134	287	153	15·3	
y, unmalted, ...	4,902	8·75	29·3	416·8	5	135	270	135	13·5	7·03
					6	122	297	175	17·5	
					7	122	241	119	11·9	
					8	122	280	158	15·8	
					Totals .	1,086	2,262	1,176	..	..
					Averages	136	283	147	14·7	7·03
Lot 2.—8 Pigs; Food—Pea-meal, and Malted Barley.										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	172	290	118	11·8	
eal . . .	560	1·00	3·7	67·9	2	144	278	134	13·4	
					3	142	242	100	10·0	
y, malted, its dust, ed					4	133	240	107	10·7	
	4,381*	7·82*	29·2*	531·0*	5	130	221	91	9·4	5·50
					6	124	228	104	10·4	
					7	119	214	95	9·5	
					8	123	196	73	7·3	
					Totals .	1,087	1,912	825	..	..
					Averages	136	239	103	10·3	5·50
Lot 3.—8 Pigs; Food—Pea-meal, Unmalted and Malted Barley (with malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	147	280	133	13·3	
al . . .	490	1·00	3·4	50·8	2	150	287	137	13·7	
					3†	(150)	(163)	(13)	—	
, unmalted, ...	3,491	7·12	24·3	361·7	4	144	282	138	13·8	
					5	129	273	144	14·4	6·73
, malted, its dust, ed					6	130	280	150	15·0	
. . . .	658*	1·34*	4·6	68·2*	7	121	284	160	16·0	
					8	128	231	103	10·3	
					Totals .	952	1,917	965	..	..
					Averages	136	274	138	13·8	6·73

* These figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which ould be produced.

† No. 3 pig of this lot was killed 21 days after the commencement of the experiment; and its weights, and the total amount of food, are excluded.

TABLE XVII.—RESULTS obtained with PIGS, on BARLEY and MALT "No.

Period of Experiment 10 weeks from December 24, 1863, to March 3, 1864.

Food consumed.					Pigs.	Weights, and Increase in Live-w			
						Weights.		Increase in Live-	
	Total in 10 Weeks.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		At Commencement.	At Conclusion.	Total in 10 Weeks.	Per Head per Week.
Lot 4.—8 Pigs; Food—Pea-meal, and Unmalted Barley.									
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.
					1	150	273	123	12·3
Pea-meal . . .	560	1·00	3·5	52·2	2	147	282	135	13·5
					3	142	306	164	16·4
Barley, unmalted, *ad lib.* . .	4,527	8·08	27·9	421·8	4	140	262	122	12·2
					5	136	259	123	12·3
					6	126	245	119	11·9
					7	133	280	147	14·7
					8	112	252	140	14·0
					Totals .	1,086	2,159	1,073	..
					Averages	136	270	134	13·4
Lot 5.—8 Pigs; Food—Pea-meal, and Malted Barley (with Malt-dust).									
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.'	lbs.
					1	156	284	128	12·8
Pea-meal .	560	1·00	3·5	55·5	2	152	294	142	14·2
					3	150	298	148	14·8
Barley, malted, with its dust, *ad lib.* . .	5,289*	9·44*	32·7*	524·2*	4	130	234	104	10·4
					5	135	262	127	12·7
					6	126	270	144	14·4
					7	134	228	94	9·4
					8	130	252	122	12·2
					Totals .	1,113	2,122	1,009	..
					Averages	139	265	126	12·6
Lot 6.—8 Pigs; Food—Pea-meal, and mixture of four-fifths Unmalted and one-fifth ma Barley (with Malt-dust) *ad lib.*									
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.
					1	168	350	152	15·2
Pea-meal . . .	420	1·00	3·4	50·2	2†	(157)	(262)	(105)	—
					3	133	250	117	11·7
Barley, unmalted .	2,929	6·97	24·0	350·4	4	128	270	142	14·2
					5†	(134)	(134)	(0)	—
Barley, malted, with its dust .	732*	1·74*	6·0*	87·6*	6	136	283	147	14·7
					7	128	250	122	12·2
					8	112	238	126	12·6
					Totals .	805	1,641	836	..
					Averages	134	273	139	13·9

* These figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from would be produced.

† No. 2 pig of this lot died 43 days after the experiment commenced, and No. 5 pig was killed on the 18th experiment. Their weights, and the proportional amount of food, are excluded.

cases the live-weights upon which the per-centages of the carcasses are calculated were taken some days later than the conclusion of the exact feeding experiment.

The actual live and dead weights are given in Table L., and the per-centages of the dead weights in the live-weights in Table LI., pp. 134-137 in the Appendix.

The per-centages of carcass or dead weight in unfasted live-weight are summarised in Table XVIII., which now follows:—

TABLE XVIII.—PER-CENTAGES of DEAD or CARCASS-WEIGHTS (cold) in UNFASTED LIVE-WEIGHTS.

PIGS.

No.	Lot 1.	Lot 2.	Lot 3.	Lot 4.	Lot 5.	Lot 6.
	Barley No. 1.			Barley No. 2.		
	Unmalted.	Malted.	Unmalted and Malted; each, ad lib.	Unmalted.	Malted.	Mixture: ⅔ Unmalted, ⅓ Malted.
1	79·1	78·4	76·5	78·3	80·2	78·7
2	80·7	78·2	76·2	80·0	[illegible]·0	*
3	77·3	77·7	*	77·4	78·9	76·6
4	78·1	82·9	78·2	79·9	77·1	77·9
5	77·0	77·5	77·4	78·8	78·5	*
6	80·1	79·0	78·0	80·0	77·8	75·0
7	82·6	75·0	78·1	78·7	77·9	80·5
8	79·1	80·1	77·5	76·2	75·0	78·3
Means.	79·3	78·6	77·4	78·6	77·9	77·8

The pigs had increased in frame a good deal whilst feeding on bran and barley-meal before the commencement of the experiments, and, for their size, none of them were very fat at the conclusion. The table shows that the average proportion of carcass was greater in pen 1, with barley No. 1 unmalted, than in either pens 2 or 3, with the same barley either entirely or in part malted. It was also greater in pen 4, with barley No. 2 unmalted, than in either pens 5 or 6, with the same barley wholly or in part malted. With both qualities of grain, however, there was a slightly better average proportion of dead weight where the whole than where only a part of the additional food consisted of malt. But it will be remembered that the amount of increase and its proportion to food consumed were notably greater with the smaller proportion of malt, and as the

* No. 3 pig of Lot 3 was killed 21 days after the commencement of the experiment; No. 2 pig of Lot 6 died 43 days after the experiment commenced; and No. 5 pig (Lot 6) was killed on the 15th day of the experiment.

two Lots 3 and 6, which had the smaller proportion, were thos which were not killed until several days after the conclusion c the feeding experiment, there is not the same reliance to b placed in the proportion of the carcass to the unfasted liv weights, the latter being at any rate different from those taken a the conclusion of the feeding experiment, after which the feedin was possibly not quite so regular, and the animals perhaps fulle and, therefore, heavier in proportion to the carcass, at the tim their final unfasted weights were taken.

An inspection after killing showed the comparative charact of the carcasses to be as follows:—

Pen 1, with barley No. 1 unmalted;—much alike, of ve good quality, but not fully ripe.

Pen 2, with barley No. 1 malted;—uneven, pig No. 1 pret ripe, of good colour, and had a good flare, as al had pig 2, whilst Nos. 4, 5, 6, 7, and 8 appeared have been wasting, and, as will be seen by referen to Table XLVIII. p. 130 in the Appendix, thos animals, especially pig No. 4 (which, however, gav a high proportion of dead weight), fell off ver much in rate of increase during the last few week of feeding.

Pen 3, with barley No. 1 unmalted and malted each *ad libitum*;—pork very firm, and of good quality; flesh very white.

Pen 4, barley No. 2 unmalted;—pork very good, and but little difference among the individuals of the pen.

Pen 5, barley No. 2 malted;—pork of very good quality.

Pen 6, barley No. 2, four-fifths unmalted and one-fifth malted;—pork very white in the flesh, and of very good quality.

The general result with the pigs was:—that more increase in live-weight, and more meat, were obtained from a given amount of barley unmalted than from an equal amount of the same barley malted; that the progress of the animals, and the quality of the meat, were less uniform when a considerable quantity of malted barley was given; that when only a moderate quantity of malt was given the quality of the meat was very good; and lastly, that, considering the difference in the amount of increase in live-weight yielded for a given amount of food consumed there was comparatively little difference in the proportion c dead weight to live with the unmalted and the malted barle; but such as it was it was in favour of the unmalted.

SUMMARY.

The results of the whole inquiry may be briefly enumerated as follows:—

The Loss and Chemical Changes which the Grain undergoes by malting.

1. In malting barley of fair malting quality, in the usual way, there was a loss of nearly 19 per cent. of its weight, about 12 of which were water, the remaining 7 being solid matter or food-material.

2. In malting barley of good feeding but inferior malting quality, there was a loss of about 22 per cent. of its weight, of which 15 were water, and 7 solid matter or food material.

3. The loss of solid matter consisted chiefly of starch, or other non-nitrogenous substances, but comprised also a small amount of nitrogenous or "flesh-forming," and mineral matters.

4. The most characteristic change which the grain undergoes by malting is the conversion of a portion of its starch into dextrine, and the further conversion of a portion of the latter, amounting to from 8 to 10 per cent. of the grain, into sugar.

5. By malting, the grain acquires properties, by virtue of which, when the malt is digested with water, much of its own remaining starch gradually changes into dextrine and sugar; and if the digestion be aided by heat, not only the whole of the remaining starch of the malt itself, but the starch of a considerable quantity of unmalted grain or other starchy substances mixed with it, may become so converted.

6. Owing to the great loss of moisture and non-nitrogenous substances—in fact, of total weight—which grain undergoes by malting, a given weight of the malted grain contains a larger quantity of nitrogenous or "flesh-forming" substances than an equal weight of the unmalted grain; but as there is an actual loss of those substances by malting, a given weight of malt will, of course, contain less of them than the amount of barley from which it was produced.

Malting and the use of Malt for feeding.

7. It is probable that if grain were malted extensively for feeding purposes, the growth would not be carried so far as in

the manufacture of malt for brewing, and the loss of solid mat or food material would, of course, be less accordingly.

8. As the "malt-dust" contains a considerable amount food material, abstracted from the grain during growth, wh malt is used for feeding the "dust" should either not separated, or, if separated, should be given to the animals alo with the screened malt.

9. Owing to the loss of weight which grain undergoes malting, equal weights of malted and unmalted grain should i be employed in comparative feeding experiments, but only much malt (with the dust) as would be produced from t amount of raw grain given, or to be substituted, in the paral experiment.

10. Malt given as food to animals may be supposed to simply by supplying more or less of the starch of the grain fr which it was produced in the more soluble and, perhaps, the fore, more easily digestible conditions of dextrine and sugar, also by aiding the conversion into dextrine and sugar of starch of other foods given with it.

The Experiments with milking Cows.

11. A comparative experiment was made in which, besi other appropriate food, 10 cows received, for a period of weeks, 3 lbs. of fair malting barley per head per day, and ot 10 received the amount of malt (with its dust) produced fr 3 lbs. of barley from the same stock.

12. In the experiment in which the malt was given it cont buted about 7½ per cent. of the solid matter of the total food.

13. The result was, that almost exactly the same amount milk was yielded for a given amount of food with the unmalt and with the malted barley, but that the milk from the co having the unmalted barley contained the higher proporti of cream.

The Experiments with fattening Oxen.

14. A comparative feeding experiment was made for a peri of 20 weeks, in which, with other appropriate food, 10 ox received 4 lbs. of good feeding barley per head per day, a other 10 the amount of malt (with its dust) produced from 4 lt of barley from the same stock.

15. In the experiment with malt it contributed about 13¼ p cent. of the dry or solid substance of the food.

16. Both lots of oxen gave more than an average amount increase, whether reckoned in proportion to a given live-weig within a given time, or to a given amount of food consume

but the 10 having the unmalted barley gave rather more than those having the malted.

17. The barley-fed oxen also gave rather the higher proportion of dead-weight to live, and, although neither lot was fully ripe, the barley-fed animals were more even in condition and quality than the others; but the beef of some of the malt-fed ones was decidedly superior in point of ripeness and quality, and that of others decidedly inferior to that of any of the barley-fed oxen.

18. It would seem, therefore, that the effect of the malt as food was more dependent on the constitution and condition of the individual animals than was that of the barley; and it should be remarked that the oxen which fattened the best upon the malt were not the most backward or weakly animals, but those which were the heaviest and in the best condition at the commencement.

The Experiments with fattening Sheep.

19. Comparative experiments were made for a period of 20 weeks with five lots of sheep, of 12 each. Besides other appropriate food given equally to all, the allowance per head per day was—to Lot 1 from $\frac{3}{4}$ to 1 lb. of fair malting barley; to Lot 2 the malt (with its dust) from an equal amount of the same barley; to Lot 3 from $\frac{3}{4}$ to 1 lb. of good feeding barley; to Lot 4 the malt (with its dust) from an equal amount of the same barley; and to Lot 5 an equal amount of the same barley, two-thirds unmalted and one-third malted.

20. In experiments 2 and 4, the malt contributed about $22\frac{1}{2}$ per cent., and in experiment 5 about $7\frac{1}{2}$ per cent., of the dry or solid substance of the food.

21. All five lots of sheep gave about an average amount of increase; there was very little difference in the result obtained with the unmalted and the malted grain; but such as it was it was rather in favour of the unmalted.

22. The mutton of all five lots was of very good quality; there was no appreciable difference between the lots in this respect, but the barley-fed animals gave slightly the higher proportion of dead-weight to live-weight.

The Experiments with fattening Pigs.

23. The appropriate food of the fattening pig contains a larger proportion of starch than does that of either cows, oxen, or sheep. If, therefore, the starch of food be rendered more digestible and assimilable by its artificial conversion into the more soluble forms of dextrine and sugar, it might be supposed

that it would be peculiarly advantageous to malt a part, or whole, of the characteristically starchy food of the fattening]

24. Experiments were made for a period of 10 weeks with lots of pigs of eight each. Besides 1 lb. of pea-meal per h per day given to all—Lot 1 had crushed malting barley, Lc the crushed malt (with its dust) from the same barley, and L the unmalted and the malted barley, each separately, *ad libiti* Lot 4 had crushed feeding barley, Lot 5 the crushed malt (v its dust) from the same barley, Lot 6 the same barley, four-fi unmalted and one-fifth malted, *ad libitum.*

25. In experiment 2 the malt contributed 87½, in experin 3 about 13, in experiment 5 about 89, and in experiment 6 al 16½ per cent., of the dry or solid substance of the food.

26. The pigs having pea-meal and entirely unmalted ba (Lots 1 and 4) gave a full average amount of increase, botl relation to a given live-weight within a given time, and t given amount of food consumed ; those having only a small portion of malted barley (Lots 3 and 6) increased in l respects, nearly, but not quite, as well ; but those having the] meal and entirely malted barley (Lots 2 and 5, more especi Lot 2), gave less increase in relation to a given live-we within a given time, and required the expenditure of consider more barley to produce a given amount of increase.

27. The pigs having the unmalted barley (Lots 1 and 4) gave the best average proportion of dead-weight to live-wei and their pork was of very good quality ; and with the excep of Lot 2 having (besides the pea-meal) entirely malted ba No. 1, the pork of the other lots was also of very good qua but the more evenly so where only a small proportion of ı was given (Lots 3 and 6).

General Conclusions.

28. The general conclusion from the results of the di experiments with cows, oxen, sheep, and pigs, is, that a g weight of barley is more productive, both of the milk of c and of the increase in live-weight of fattening animals, than amount of malt and malt-dust that would be produced from i

29. The results of these new experiments, as here stated, consistent with those obtained in an official inquiry conducte 1845-6, by the Drs. Thomas and Robert Dundas Thom with cows and with oxen. They are consistent with the res of experiments made at Rothamsted, in 1848 and 1849, sheep ; and also with those of others made in 1854 with pig which some were fed on sugar.

30. Wherever weights have been taken as a measure of effects produced, experience hitherto has failed to show

advantage in malt over the amount of barley from which it would be produced, as a staple food for healthy milking cows or fattening animals; and, if no advantage, there must, in point of economy, be a loss, on account of the cost of the malting process.

31. Irrespectively of economy, malt is undoubtedly a very good food for stock; and common experience seems to show that a certain amount of it is beneficial when given in admixture, and in change, with other food, to young or weakly animals, or in "making up" or "finishing" for exhibition or sale; that is, when the object is to produce a particular result irrespective of the economy required in ordinary feeding.

JOHN BENNET LAWES.

Rothamsted, Herts, August, 1865.

APPENDIX.

The Determination of the Sugar in the Barley, and in the Products of the Malting Process.

As each of the several methods for the quantitative estimation of sugar seemed possibly open to some objection when applied to complex solutions such as the extract of malted grain, or malt-dust, it was decided, for the sake of confirmation, in all cases to adopt two methods, and always to make at least two experiments with each. The following is an outline of the methods adopted; and in Table 1 (p. 59) are given the results of each individual experiment.

1. *Determination by the Fermentation and Alcohol Method.*

The grain, unmalted or malted as the case might be, being finely ground, 630 grains were stirred up with 200 septems * of cold water, and the mixture allowed to stand for about an hour. It was then well rubbed in a mortar, and transferred to a bottle, 1000 septems of water being used in rinsing the mixture into the bottle, and then 500 septems more were added, making in all 1700 septems of water and 630 grains of substance. The mixtures were generally made about the middle of the day, well shaken at intervals throughout the afternoon, and then allowed to stand to settle till the next morning, when as much as possible of the supernatant liquid was removed by means of a syphon. The solutions were turbid, but did not react with iodine. To 1000 septems 100 septems of lime-water were added, and the mixture was very slightly warmed to expedite precipitation, after which there remained a perfectly clear, but coloured supernatant liquid. Of this 700 septems were taken for fermentation, and the remainder was left for the determination of the sugar by the copper method.

In the preparation of the extract from the malt-dust some deviation from the above mode of procedure was made. In its case, 200 septems of *milk* of lime were added to 800 septems of the original infusion, and, after filtration, only 600 septems of the liquid were taken for fermentation, the remainder, as before, being left for the copper method.

From the above figures it results that the extract submitted to fermentation represented in the case of the malt-dust, 177·9 grains, and in that of the barley and of the other products of the malting process, 235·8 grains of original substance.

The yeast employed was pressed in a cloth, or between blotting paper, and then well mixed before being weighed out for use. Of the

* 1 septem measure = 7 grains, or $\frac{1}{1000}$th of a pound avoirdupois, of water.

o prepared yeast 90 grains were employed for each fermentation; and two lots, of 90 grains each, were always mixed with water, and left to erment side by side with the fermenting extracts, the whole being naintained as nearly as possibly at a temperature of 78° F.

At the conclusion of the fermentation, each fluid was submitted to listillation, and the distillate was weighed in a 1000-grain bottle, in uccessive quantities as it was collected, until the specific gravity howed that only pure water came over. The sum of the attenuation f the several separately weighed lots of the distillate, less that of the listillate from the yeast fermented with pure water, gave the total ttenuation in 1000 grain measures due to the alcohol formed from he sugar of the substance experimented upon. The amount of proof pirit which 1000 grain measures of spirit of the attenuation thus found being ascertained by reference to Bate's Tables (and interpolation), it only remained to calculate the amount of alcohol which that amount of proof spirit represented, and then the amount of sugar (dry malt- or grape-sugar = $C_{12}\ H_{12}\ O_{12}$) to which the amount of alcohol was equivalent, thus:—

$$\frac{x \times 180}{92} = \text{malt-sugar.}$$

2. *Determination by the Copper Method.*

A standard solution was made by dissolving, separately, in water:—

245 grains of crystallized sulphate of copper,
700 grains of crystallized tartaric acid,
840 grains of fused caustic soda,

mixing the solutions, and making up with water to 1000 septems at 62° F.

According to calculation, on the assumption that 1 equivalent of grape sugar would reduce 10 equivalents of oxide of copper, 100 septems of this solution should indicate 3·535 grains, or 1 septem ·03535 grain of grape-sugar.

Another standard solution was made by dissolving—

242·98 grains of crystallized sulphate of copper,
700 grains of crystallized tartaric acid,
840 grains of fused caustic soda,

and making up to 1000 septems. Of this solution 100 septems represented, by calculation, 3·506 grains, or 1 septem ·03506 grain of grape-sugar.

The actual value of each of these solutions was determined from time to time by means of a solution made by dissolving 10 grains of pure cane sugar in 2 or 3 ounces of water, adding 20 or 30 drops of strong sulphuric acid (previously diluted), boiling for a short time to convert the cane sugar into grape-sugar, and when cold making up to 500 septem measures with water. Each septem of this solution represented, therefore, ·02 grain of cane-sugar, or

$$\frac{\cdot 02 \times 180}{171} = \cdot 02105 \text{ grain dry grape-sugar.}$$

In testing the value of the solutions, or in actual working, 50 o 100 septem measures of the copper solution were put into a smal flask and heated by means of a water bath. The solution of sugar, o prepared grain-extract, was then allowed to flow in by degrees from burette,' until the point of saturation was attained. Even with th solutions of pure sugar, it was difficult to determine by the eye whe the whole of the copper was precipitated, nearer than by one or tw septems of the solution; and with the coloured grain-extracts th difficulty, and range of error in reading, were, of course, increased In practice it was found necessary, as the point of saturation wa approached, from time to time to remove a few drops, filter, and tes by a solution of yellow prussiate of potass.

The Determination of the Woody-fibre, in the Barley, and in the Produc of the Malting Process.

For each determination 12 grammes (185·2 grains) of the fine ground substance were taken. 1200 septems of dilute sulphuric ac made by mixing 1 volume of oil of vitriol and 16 volumes of wat were put into a flask with a wide mouth closed by means of a sm funnel to prevent loss by evaporation, and then heated to the boili point. The substance was then added, the mixture well shaken, k at the boiling point for precisely 15 minutes, filtered immediat and washed with hot water until the washings no longer redde blue litmus paper. The solid matter was then washed from the fil by means of hot water, and more hot water added to make up to t same volume as before, namely, 1200 septems. The mixture bei brought to the boiling point, in the flask as before, there was th added exactly sufficient of a concentrated solution of caustic potass known strength to bring the whole to 1 per cent. alkali. This w then boiled for precisely 15 minutes, the supernatant fluid filtered rapidly as possible (the filtration being much expedited by pouri boiling water into the filter along with the fluid), and finally the so matter transferred to the filter, and washed as rapidly as possible wi boiling water. The washing was continued until the filtrate no long turned reddened litmus paper blue; then two or three drops of dil sulphuric acid were added, and the washing continued with boili water until the washings no longer turned blue litmus paper re The residue on the filter was then transferred to a small cover crucible, dried at 212°, and weighed, the result representing cru woody-fibre. Of this, a weighed portion was burnt, to determine th amount of mineral matter; another portion was taken for the dete mination of nitrogen, which, multiplied by 6·3 gave the amount nitrogenous substance. The amount of mineral and nitrogeno matters so determined were then deducted, by calculation, from th crude woody-fibre, the remainder representing the woody-fibre entered in Table II., p. 60.

Dates of Sampling.	Number of Days growing.	Description.	Per Cent. Dry Substance in the Condition of Dryness as analysed.	In the Condition of Dryness as analysed. By Fermentation & Alcohol Method. Expt. 1.	Expt. 2.	Expt. 3.	Mean.	By Copper Method. Expt. 1.	Expt. 2.	Expt. 3.	Mean.	Mean by the Two Methods.	Mean, by the Two Methods. In Condition of Moisture as sampled.	In the Dry Substance.	In the Barley, Malt, and Dust, as sampled; in others in same Dryness as Malt.
Barley "No. 1."															
Oct. 30	—	Barley	92·1	2·53	2·42	2·34	2·43	2·32	2·23	2·23	2·26	2·35	2·11	2·55	2·11
Nov. 2	—	As thrown from the couch	93·9	1·56	1·56	—	1·56	1·37	1·36	—	1·37	1·47	0·89	1·56	1·46
„ 6	4½	On the floor	93·6	7·59	7·78	—	7·68	7·58	7·58	—	7·58	7·63	4·74	8·16	7·61
„ 10	8	Do.	92·7	9·35	9·54	—	9·44	9·46	9·46	—	9·46	9·45	5·95	10·19	9·51
„ 12	10½	Do. (1st third to kiln)	Not sampled.	—	—	—	—	—	—	—	—	—	—	—	—
„ 14	12½	Do. (2nd third to kiln)	94·5	11·23	11·01	—	11·12	10·94	10·94	—	10·94	11·03	6·92	11·67	10·90
„ 16	14½	Do. (3rd third to kiln)	91·6	10·89	11·01	—	10·95	11·29	11·29	—	11·29	11·12	7·23	12·14	11·33
—	—	Screened malt	91·4	10·38	10·70	10·27	10·45	10·20	10·20	10·66	10·35	10·40	10·62	11·38	10·62
—	—	Malt-dust	91·9	10·64	10·48	10·17	10·43	13·12	13·12	13·02	13·08	10·43*	10·01*	11·35*	10·01*
Barley "No. 2."															
Nov. 3	—	Barley	93·8	3·11	3·20	3·03	3·11	3·64	3·47	3·17	3·43	3·27	2·83	3·49	2·83
„ 6	—	As thrown from the couch	93·8	2·03	2·13	—	2·08	1·83	1·82	—	1·83	1·96	1·14	2·08	1·99
„ 10	4	On the floor	93·8	6·22	6·51	—	6·36	6·41	6·41	—	6·41	6·39	3·73	6·80	6·49
„ 14	8	Do.	93·6	10·27	10·38	—	10·32	10·10	10·10	—	10·10	10·21	6·13	10·91	10·40
„ 17	11	Do. (1st third to kiln)	94·4	9·88	9·74	—	9·81	10·28	10·17	—	10·22	10·02	5·95	10·60	10.11
„ 19	13	Do. (2nd third to kiln)	92·1	9·88	9·54	—	9·71	10·28	10·07	—	10·17	9·94	6·29	10·79	10·29
„ 21	15	Do. (3rd third to kiln)	93·5	10·70	10·48	—	10·59	10·95	10·95	—	10·95	10·77	6·86	11·52	10·98
—	—	Screened malt	91·4	11·01	10·70	11·11	10·94	10·59	11·01	—	10·80	10·87	11·34	11·89	11·34
—	—	Malt-dust	91·4	11·44	11·44	11·75	11·54	13·56	13·56	13·81	13·64	11·54*	10·89*	12·62*	10·89*

* In the cases of the malt-dust, the results by the fermentation and alcohol method are alone adopted; those by the copper method being supposed to be too high owing to reduction by other matters than sugar in the malt-dust extract. The probability of this was confirmed by determinations made by extraction of the malt-dust with spirit, expulsion of the alcohol by evaporation, and submitting the residue to fermentation in the ordinary way, when the results obtained were much below those by the copper method, and corresponded fairly with those obtained by the fermentation of the usual aqueous extract.

TABLE II.—SHOWING the DETERMINATIONS of WOODY-FIBRE, in the BARLEY, [redacted] in the PRODUCTS of the MALTING PROCESS.

Particulars of the Sampling.					Per Cent. Woody Fibre.				
Dates of Sampling.		Number of Days growing.	Description.	Per Cent. Dry Matter in Condition as sampled.	[redacted] the Dry Substance. Expt. 1.	Expt. 2.	Mean.	In the Condition of Moisture as sampled.	In the Barley, Malt, and Dust, as sampled; in others in the same Dryness as Malt.
			Barley "No. 1."						
Oct.	30		Barley	82·4	4·75	4·62	4·69	3·96	3·96
Nov.	2	—	As thrown from the couch	57·3	5·22	5·23	5·23	2·99	4·88
,,	6	4½	On the floor	58·1	4·97	4·96	4·96	2·88	4·63
,,	10	8	Ditto	58·4	5·22	5·14	5·18	3·02	4·84
,,	12	10½	Ditto (1st third to kiln)	Not sampled.	—	—	—	—	—
,,	14	12½	Ditto (2nd third to kiln)	59·3	4·88	5·07	4·98	2·95	4·65
,,	16	14½	Ditto (3rd third to kiln)	59·6	5·00	5·06	5·03	3·00	4·69
			Screened Malt	93·3	4·69	4·78	4·64	4·52	4·52
			Malt-dust	88·3	8·61	8·73	8·67	8·64	8·64
			Barley "No. 2."						
Nov.	3		Barley	81·9	5·56	5·47	5·51	4·47	4·47
,,	6		As thrown from the couch	54·7	Lost	5·61	5·61	3·07	5·34
,,	10	4	On the floor	54·9	5·25	5·20	5·22	2·87	4·88
,,	14	8	Ditto	56·2	5·61	5·60	5·60	3·15	5·34
,,	17	11	Ditto (1st third to kiln)	56·1	6·02	5·80	5·91	3·32	5·63
,,	19	13	Ditto (2nd third to kiln)	59·3	5·56	5·67	5·61	3·27	5·36
,,	21	16	Ditto (3rd third to kiln)	59·6	6·12	5·90	6·01	3·58	5·73
			Screened Malt	95·3	5·72	5·78	5·75	5·49	5·49
			Malt-dust	88·2	9·54	9·96	9·75	8·41	8·41

Particulars of the Sampling.			Per Cent. Dry Matter, in the Condition of Moisture as sampled.	Per Cent. Nitrogen.					Per Cent. Nitrogenous Substance (N : × 6·3).		
				In the Dry Substance.							
Dates of Sampling.	Number of Days growing.	Description.		Expt. 1.	Expt. 2.	Expt. 3.	Expt. 4.	Mean.	In the Condition of Moisture as sampled.	In the Dry Substance.	In the Barley, Malt, and Dust, as sampled; in others in the same Dryness as Malt.
		Barley "No. 1."									
Oct. 30		Barley	82·4	1·59	1·54	1·56	1·54	1·56	8·09	9·83	8·09
Nov. 2		As thrown from the couch	57·3	1·58	1·54	1·56	1·57	1·56	5·63	9·83	9·17
" 6	4½	On the floor	58·1	1·51	1·59	1·59	1·60	1·57	5·75	9·89	9·23
" 10	8	Ditto	58·4	1·53	1·61	1·62	1·66	1·61	5·92	10·14	9·47
" 12	10½	Ditto (1st third to kiln)	Not sampled.	—	—	—	—	—	—	—	—
" 14	12½	Ditto (2nd third to kiln)	59·3	1·53	1·69	1·63	1·68	1·63	6·09	10·27	9·59
" 16	14½	Ditto (3rd third to kiln)	59·6	1·67	1·66	1·57	1·68	1·65	6·19	10·40	9·70
		Screened Malt	93·3	1·61	1·58	1·59	1·54	1·58	9.29	9·95	9·29
		Malt-dust	88·3	4·23	4·18	4·30	4·38	4·27	23·75	26·90	23·75
		Barley "No. 2."									
Nov. 3		Barley	81·0	1·93	1·92	1·96	1·96	1·94	9·91	12·22	9·91
" 6		As thrown from the couch	54·7	1·92	1·90	1·92	1·93	1·92	6·61	12·10	11·53
" 10	4	On the floor	54·9	1·96	1·95	1·96	1·89	1·94	6·71	12·22	11·65
" 14	8	Ditto	56·2	1·99	1·97	1·95	1·94	1·96	6·94	12·35	11·77
" 17	11	Ditto (1st third to kiln)	56·1	1·88	1·99	2·05	1·96	1·97	6·98	12·44	11·86
" 19	13	Ditto (2nd third to kiln)	58·3	1·96	2·06	1·97	1·99	1·99	7·31	12·54	11·97
" 21	15	Ditto (3rd third to kiln)	59·6	2·04	2·03	2·07	1·98	2·03	7·62	12·79	12·19
		Screened Malt	95·3	1·95	1·86	1·87	1·88	1·89	11·35	11·91	11·35
		Malt-dust	86·2	4·07	4·13	4·03	4·00	4·06	22·06	25·58	22·06

Table IV.—Details of the Sampling, and of the Determinations of the Dry Substance and Mineral Matter (Ash) in the Barley, and in the Products of the Malting Process.

Barley "No. 1."

Particulars of Sampling.			Actual Weights.				Per-centages.					
							Dry in Fresh.		Ash in Fresh.		Ash in Dry.	
Dates of Sampling.	Number of Days growing.	Description.	As sampled.	Taken for drying and burning.	Dried at 212° F.	Burnt (Ash).	Each Experiment.	Mean.	Each Experiment.	Mean.	Each Experiment.	Mean.
			lbs.	ozs.	ozs.	ozs.						
Oct. 30	—	Barley	25[1]	99·96 99·96	82·31 82·34	2·038 2·076	82·34 82·37	82·36	2·039 2·077	2·058	2·476 2·521	2·499
Nov. 2	—	As thrown from the couch	25	100·00 100·00	57·23 57·36	1·306 1·290	57·23 57·36	57·30	1·306 1·290	1·298	2·282 2·249	2·266
„ 6	4½	On the floor	25[2]	99·98 99·98	58·05 58·18	1·315 1·327	58·06 58·19	58.13	1·315 1·327	1·321	2·265 2·281	2·273
„ 10	8	Do.	25[3]	99·97 99·97	58·29 58·38	1·365 1·352	58·31 58·39	58·35	1·365 1·352	1·359	2·342 2·316	2·329
„ 12	10½	Do. (1st third to kiln)	(Not sampled).									
„ 14	12½	Do. (2nd third to kiln)	25[4]	99·97 99·97	59·24 59·29	1·392 1·392	59·26 59·31	59·29	1·392 1·392	1·392	2·350 2·348	2·349
„ 16	14½	Do. (3rd third to kiln)	25[5]	99·96 99·96	59·56 59·51	1·396 1·402	59·58 59·53	59·56	1·397 1·403	1·400	2·344 2·356	2·350
		Screened Malt	25[6]	99·92 99·92	92·89 93·63	2·015 2·032	92·97 93·71	93·34	2·017 2·034	2·026	2·169 2·170	2·170
		Malt-dust	12·57[7]	49·93 49·93	44·04 44·11	3·690 3·716	88·20 88·33	88·27	7·390 7·442	7·416	8·379 8·425	8·402

... picked out. ... ozs. of stones, &c., picked out. ... ozs. of stones, &c., picked out.

in the BARLEY, and in the PRODUCTS of

Barley No. 2.

Particulars of Sampling.			Actual Weights.				Per-centages.					
Dates of Sampling.	Number of Days growing.	Description.	As sampled.	Taken for drying and burning.	Dried at 212° F.	Burnt (Ash).	Dry in Fresh. Each Experiment.	Dry in Fresh. Mean.	Ash in Fresh. Each Experiment.	Ash in Fresh. Mean.	Ash in Dry. Each Experiment.	Ash in Dry. Mean.
			lbs.	ozs.	ozs.	ozs.						
Nov. 3	—	Barley	25[1]	99·46 99·46	80·53 80·67	2·052 2·092	80·97 81·10	81·04	2·063 2·103	2·083	2·548 2·593	2·571
,, 6	—	As thrown from the couch	25[2]	99·72 99·72	54·58 54·47	1·420 1·402	54·73 54·62	54·68	1·424 1·406	1·415	2·602 2·574	2·588
,, 10	4	On the floor	25[3]	99·79 99·79	54 78 54·71	1·444 1·345	54·90 54·82	54·86	1·447 1·348	1·398	2·636 2·458	2·547
,, 14	8	Do.	25[4]	99·81 99·81	55·96 56·20	1·537 1·535	56·07 56·31	56·19	1·540 1·538	1·539	2·747 2·731	2·739
,, 17	11	Do. (1st third to kiln)	25[5]	99·79 99·79	55·83 56·15	1·580 1·616	55·95 56 27	56·11	1·583 1·619	1·601	2·830 2·878	2 854
,, 19	13	Do. (2nd third to kiln)	25[6]	99·78 99·78	58·06 58·22	1·675 1·628	58·18 58·34	58·26	1·679 1·632	1·656	2·885 2·797	2·841
,, 21	15	Do. (3rd third to kiln)	25[7]	99·74 99·74	59·35 59·51	1·653 1·690	59·51 59·67	59·59	1·657 1·694	1·676	2·785 2·840	2·813
		Screened Malt	25[8]	99·57 99·57	94·81 95·01	2·325 2 386	95·22 95·43	95·33	2·335 2 396	2·366	2·452 2·511	2·482
		Malt-dust	12·5[9]	49·69 49·69	42·88 42·81	3·830 3·942	86 31 86·15	86·23	7·708 7·934	7·821	8·931 9 209	9·070

[1] 2·158 ozs. of stones, &c., picked out.
[4] 0·771 ,, ,,
[7] 1·043 ,, ,,

[2] 1·104 ozs. of stones, [illegible] picked out.
[5] 0·855 ,, ,,
[8] 1·73 ,, ,,

[3] 0·845 ozs. of stones, &c., picked out.
[6] 0·869 ,, ,,
[9] 1·256 ,, ,,

TABLE VI.—SHOWING the ACTUAL WEIGHTS of the BARLEY, MALT (and intermediate Products), and also the QUANTITIES of each, and some of their CONSTITUENTS, as corrected by Calculation for the Amounts removed as Samples during the MALTING PROCESS.

Particulars of the Sampling.			Actual Weights.				Quantities as corrected for Samples taken.				
Dates of sampling (1863.)	Number of Days growing.	Description.	Number of Bushels.	Weight per Bushel.	Total Weight.	Taken for Samples.	In Condition of Moisture, as sampled.	Total Dry Substance.	Mineral Matter (Ash).	Dry Organic Matter.	Nitrogen.
		Barley "No. 1."									
				lbs. ozs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Oct. 30		Barley	280	54 10	15,295	—	15,295	12,597	314¾	12,282¼	196·5
Nov. 2		As thrown from the couch	401	54 9·74	21,898	25	21,898	12,547¼	284½	12,263¼	195·7
,, 6	4½	On the floor	508	42 8	21,434	25	21,458¼	12,473¾	283¼	12,190¼	195·8
,, 10	8	Do.	547	37 12	20,657½	25	20,705	12,081¼	281⅛	11,799¾	194·5
,, 12	10½	Do. (1st third to kiln)	—	—	—	—	—	—	—	—	—
,, 14	12½	Do. (2nd third to kiln)	—	—	—	25	—	—	—	—	—
,, 16	14½	Do. (3rd third to kiln)	—	—	—	25	—	—	—	—	—
		Screened Malt	290	41 10	12,002½	—	12,072¼	11,268¾	244½	11,024	178·0
		Malt-dust			334	—	336	296¼	25	271¼	12·7
							12,406¼	11,565	269½	11,295¼	190·7
		Barley "No. 2."									
Nov. 3		Barley	280	50 10	14,175	—	14,175	11,487¼	295¼	11,192¼	222·9
,, 6		As thrown from the couch	397	52 9·1	20,869¾	25	20,869¾	11,411¼	295¼	11,116¼	219·1
,, 10	4	On the floor	—	—	—	25	—	—	—	—	—
,, 14	8	Do.	594¾	32 15·4	19,606	25	19,653¾	11,043¼	302¼	10,741	216·5
,, 17	11	Do. (1st third to kiln)	—	—	—	25	—	—	—	—	—
,, 19	13	Do. (2nd third to kiln)	—	—	—	25	—	—	—	—	—
,, 21	15	Do. (3rd third to kiln)	—	—	—	25	—	—	—	—	—
		Screened Malt	284	37 4	10,499	—	10,578	10,084	250¼	9,833¾	190·6
		Malt-dust			451	—	454½	392	35¼	356¼	15·9
							11,032½	10,476	285¾	10,190¼	206·5

Table VII.—Results of the partial Analysis of Water before and after being used for "Steeping" Barley.

Constituents.	Grains per Gallon.
Pump Water before being used for Steeping.	
Organic matter	2·79
Mineral matter	26·30
Total solid matter . . .	29·09
Water from the Cistern after Steeping.	
Organic matter	265·05[a]
Mineral matter	155·70
Total solid matter . . .	420·75

[a] Containing Nitrogen 8·62 = Nitrogenous substance 54·31.

TABLE VIII.—RESULTS of the PARTIAL ANALYSIS of the BARLEY, MALT, and MALT-DUST (and intermediate Products) used in EXPERIMENTS with SHEEP, at ROTHAMSTED, in 1849.

—	Barley before steeping.	Growing. Feb. 18; as thrown from the Couch.	Feb. 22; 4 Days on the Floor.	Feb. 26; 8 Days on the Floor.	March 3; 13 Days on the Floor.	Mar. 6; 16 Days on the Floor.	Screened Malt.	Malt and Kiln-dust.
1.—In the Condition of Moisture as sampled.								
Starch, sugar, woody-fibre, &c.	70·37						82·57	59·23
Albuminous (or "flesh-forming") matters[1]	9·14						10·21	25·83
Mineral matter (ash)	2·33						2·61	8·70
Total solid matter	81·84	57·74	57·86	58·22	58·83	59·76	95·39	93·76
Moisture	18·16	42·26	42·14	41·78	41·17	40·24	4·61	6·24
Total	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
(1) Containing nitrogen	1·45						1·62	4·10
2.—Exclusive of Moisture.								
Starch, sugar, woody-fibre, &c.	85·95						86·56	63·12
Albuminous (or "flesh-forming") matters[2]	11·21						10·71	27·59
Mineral matter (ash)	2·84						2·73	9·29
Total solid matter	100·00						100·00	100·00
(2) Containing nitrogen	1·78						1·70	4·38

	Barley before Steeping.	Feb. 22; 4 Days on the Floor.	Feb. 26; 8 Days on the Floor.	Mar. 3; 13 Days on the Floor.	Final Products. Screened Malt.	Final Products. Malt and Kiln-dust.	Final Products. TOTAL.	Loss.
Actual Weights, Lbs.								
As sampled	7,632	10,504	10,415	10,010	5,907¾	266	6,173¾	1,458¼
Total dry or solid matter	6,246	6,078	6,063	5,889	5,635½	249½	5,885	361
Non-nitrogenous organic matter	5,371				4,878¾	157¾	5,036½	334½
Nitrogenous matter	697·2				602·9	68·7	671·6	25·6
Mineral matter	177·5				153·9	[1]23·1	[1]177·0	[1]0·5
Proportion to 100 before steeping.								
As sampled	100	137·6	136·4	131·2	77·41	3·48	80·89	19·11
Total dry or solid matter	100	97·3	97·1	94·3	90·23	3·99	94·22	5·78
Non-nitrogenous organic matter	100				90·83	2·94	93·77	6·23
Nitrogenous matter	100				86·47	9·85	96·32	3·68
Mineral matter	100				86·70	[1]13·01	[1]99·71	[1]0·29

[1] The ash from the kiln-dust included some incombustible matter from the furnace, and hence the amounts of mineral matter set down for the malt and kiln-dust and for the total products, are somewhat too high, and the recorded loss of mineral matter is in a corresponding degree too low.

TABLE X.—EXPERIMENTS made with COWS, at NEW

1st Week.—Decem

	Cows.	Breed.	Years old.	Dates of Calving.		Weights of the Animals (Dec. 21).	MONDAY. A.M.		MONDAY. P.M.		TU… A.M.	
Lot 1.—Special Food.—Unmalted												
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Shorthorn .	7	May	30	1,086	16	4	9	12	13	1
	2	Cross Shorthorn .	6	Oct.	26	1,044	19	2	14	13	18	14
	3	Cross Shorthorn	Aged	April	26	1,065	17	0	9	2	16	3
	4	Cross Shorthorn	7	April	21	1,082	13	10	8	13	13	2
	5	Cross Shorthorn .	8	Sept.	26	1,020	15	7	13	4	16	0
	6	Cross Yorkshire .	7	April	14	1,164	14	9	8	3	14	6
	7	Cross Yorkshire .	10	April	9	1,260	14	2	8	7	14	0
	8	Cross Ayrshire .	5	June	15	944	16	8	9	6	16	9
	9	Shorthorn .	4	June	15	1,156	14	10	7	7	13	7
	10	Shorthorn .	7	Oct.	29	1,236	25	12	14	3	23	7
				Totals .		11,057	166	0	102	6	159	8
				Averages		1,106	16	10	10	4	16	15
Lot 2.—Special Food.—Malt and M												
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Yorkshire .	8	March	10	1,184	12	0	7	8	12	0
	2	Cross Shorthorn .	7	Oct.	27	992	16	12	10	12	18	9
	3	Shorthorn . .	8	April	29	1,260	13	6	8	4	11	7
	4	Cross Shorthorn .	7	June	19	1,020	14	12	8	12	11	15
	5	Cross Shorthorn .	6	Oct.	29	914	15	8	10	4	13	10
	6	Cross Welch . .	8	June	18	1,316	16	10	9	12	14	12
	7	Cross Shorthorn .	7	June	24	1,008	16	12	8	8	16	7
	8	Cross Yorkshire .	10	April	26	1,065	16	8	10	11	14	15
	9	Cross Shorthorn .	6	April	19	1,040	18	14	10	6	18	2
	10	Shorthorn . .	9	Nov.	20	1,206	25	4	11	13	21	14
				Totals .		11,005	168	6	96	12	153	11
				Averages		1,101	16	13	9	11	15	6

* Also an allowance, which averaged—rape-cake, 2 lbs.; bean-meal, 2 lbs.; clover-chaff

UGBY. DETAILED RECORD of the MILK YIELDED, &c.
er 27, 1863.

.	THURSDAY.				FRIDAY.				SATURDAY.				SUNDAY.				Total in Seven Days.		Per Head per Day.	
.	A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.					

lbs. per head per day.*

ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
4	14	3	8	13	12	14	9	6	12	15	10	0	12	4	8	13	158	12	22	11
9	17	7	15	4	17	2	14	1	17	5	15	12	17	11	13	11	229	2	32	12
8	16	6	9	14	16	0	9	2	17	1	9	1	16	3	9	4	180	7	25	12
6	14	0	10	3	14	7	10	1	14	8	8	6	14	13	10	8	165	14	23	11
4	13	7	11	15	14	8	11	3	16	12	11	7	16	0	11	2	187	4	26	12
10	13	11	8	0	14	0	8	4	14	11	8	5	14	6	7	13	157	6	22	8
11	13	7	9	6	12	14	8	1	14	4	8	5	13	14	8	13	156	4	22	5
12	16	1	9	6	17	1	8	9	16	12	9	3	16	10	8	12	177	13	25	6
0	13	6	8	11	13	5	7	8	14	3	7	1	14	4	7	5	150	12	21	9
10	24	7	14	4	24	6	12	6	25	8	13	4	24	2	12	6	265	12	37	15
10	156	7	105	12	156	9	98	9	163	15	100	12	160	3	98	7	1,829	6	—	
4	15	10	10	9	15	11	9	14	16	6	10	1	16	0	9	14	182	15	26	2

a. Barley (No. 1.), per head per day.*

ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
0	11	10	6	15	11	15	5	6	11	4	6	9	10	0	3	7	125	2	17	14
4	18	14	11	1	17	15	9	2	18	3	11	2	18	8	9	4	202	8	28	15
10	12	7	7	3	11	12	6	15	11	15	7	0	11	6	6	6	137	4	19	10
12	12	5	10	6	14	9	7	6	14	14	7	15	14	0	8	8	157	15	22	9
7	14	9	9	12	15	5	9	7	15	3	9	11	15	14	9	8	173	13	24	13
14	15	5	9	4	14	15	8	0	16	1	8	6	15	12	7	10	169	7	24	3
12	16	14	10	8	17	5	9	1	17	8	10	10	18	0	8	6	187	1	26	12
14	16	7	9	11	17	0	8	7	16	8	9	9	16	5	9	0	180	5	25	12
10	18	8	10	13	18	12	8	5	19	0	11	0	19	7	10	2	202	14	29	0
0	24	15	13	14	23	6	12	4	24	15	13	4	25	0	12	1	260	15	37	4
3	161	14	99	7	162	14	84	5	165	7	95	2	164	4	84	4	1,797	4	—	
10	16	3	9	15	16	5	8	7	16	9	9	8	16	7	8	7	179	12	25	11

7 lbs.; and pulped swedes, 50·4 lbs., per head per day.

TABLE XI.—EXPERIMENTS made with COWS, at NEWLANDS

2nd Week.—December 28, 1863,

—	Cows.	Breed.	Years old.	Dates of Calving.		Weights of the Animals (Dec. 21.)	MONDAY.				TUESDAY			
							A.M.		P.M.		A.M.		P.M.	
Lot 1.—Special Food.—Unmalted Barley														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Shorthorn .	7	May	20	1,086	11	6	8	10	12	10	[illegible]	[illegible]
	2	Cross Shorthorn .	6	Oct.	26	1,044	16	10	14	12	10	5	14	[illegible]
	3	Cross Shorthorn .	Aged	April	26	1,086	14	14	6	8	16	6	[illegible]	[illegible]
	4	Cross Shorthorn .	7	April	21	1,062	13	5	8	14	13	8	[illegible]	[illegible]
	5	Cross Shorthorn .	8	Sept.	26	1,020	16	2	11	6	17	4	10	[illegible]
	6	Cross Yorkshire	7	April	14	1,164	13	8	6	3	14	2	[illegible]	[illegible]
	7	Cross Yorkshire .	10	April	9	1,260	13	0	7	4	13	10	[illegible]	[illegible]
	8	Cross Ayrshire .	5	June	15	944	15	8	8	14	16	1	[illegible]	[illegible]
	9	Shorthorn . .	4	June	15	1,156	12	1	6	13	13	5	7	[illegible]
	10	Shorthorn .	7	Oct.	29	1,236	23	0	13	1	23	4	12	[illegible]
				Totals .		11,057	152	15	96	6	158	13	[illegible]	[illegible]
				Averages		1,106	15	5	9	10	15	14	[illegible]	[illegible]
Lot 2.—Special Food.—Malt and Malt-dust														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Yorkshire .	8	March	10	1,184	9	0	4	8	9	6	4	11
	2	Cross Shorthorn	7	Oct.	27	982	17	2	10	14	19	2	10	4
	3	Shorthorn . .	8	April	29	1,260	10	7	6	15	16	2	6	10
	4	Cross Shorthorn .	7	June	19	1,020	13	1	9	6	13	12	[illegible]	[illegible]
	5	Cross Shorthorn .	6	Oct.	29	914	15	6	8	2	14	15	9	[illegible]
	6	Cross Welsh . .	8	June	18	1,216	15	12	8	5	16	7	[illegible]	[illegible]
	7	Cross Shorthorn .	7	June	24	1,008	16	10	9	12	17	12	5	14
	8	Cross Yorkshire .	10	April	28	1,065	15	4	7	9	16	0	6	4
	9	Cross Shorthorn .	6	April	19	1,040	17	12	11	4	16	0	[illegible]	[illegible]
	10	Shorthorn . .	9	Nov.	20	1,206	23	10	12	8	24	3	13	[illegible]
				Totals .		11,004	154	1	88	14	158	5	[illegible]	[illegible]
				Averages		1,101	15	7	8	14	15	13	[illegible]	[illegible]

* Also an allowance, which averaged—rape-cake, 2 lbs.; bean-meal, 3 lbs.; clover-chaff, 14 lbs.;

RUGBY. DETAILED RECORD of the MILK YIELDED, &c.
ry 3, 1864.

3 lbs. per head per day.*

…AY.		THURSDAY.				FRIDAY.				SATURDAY.				SUNDAY.				Total in Seven Days.		Per Head Per Day.	
P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.					
…s.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
3	7	10	9	8	8	10	6	8	0	10	3	7	0	11	8	6	2	134	8	19	3
5	6	18	2	14	2	19	5	14	8	17	2	15	0	17	4	13	1	229	2	32	12
3	15	16	6	9	3	16	7	8	14	16	0	8	11	16	4	7	9	172	12	24	11
3	6	12	8	9	0	13	2	9	13	13	10	8	12	13	8	8	3	154	2	22	0
1	6	16	13	10	6	16	11	10	0	15	1	11	0	14	9	10	0	186	13	26	11
3	3	13	13	8	8	13	11	8	0	13	0	7	7	13	2	7	0	151	4	21	10
3	5	13	12	8	9	13	10	8	7	13	14	7	12	12	9	7	1	150	4	21	7
9	0	16	5	8	11	16	12	8	3	15	2	8	0	13	12	5	3	166	3	23	12
7	1	13	1	7	5	12	7	7	7	13	4	6	3	13	12	6	12	140	12	20	2
2	8	21	7	10	6	20	0	11	0	20	13	11	2	21	2	9	6	231	11	33	2
7	7	152	12	94	10	152	7	94	4	148	1	90	15	147	6	80	5	1,717	7	—	
9	12	15	4	9	7	15	4	9	7	14	13	9	2	14	12	8	1	171	12	24	9

…s. Barley (No. 1.), per head per day.*

…s.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
5	12	9	10	4	14	9	1	5	3	9	0	6	0	10	0	5	0	101	3	14	7
0	12	18	6	9	9	18	4	9	5	17	0	7	2	17	0	8	8	190	3	27	3
6	10	10	6	8	2	9	15	5	10	8	10	5	12	8	0	4	10	112	4	16	1
8	8	14	8	9	10	13	11	9	10	14	13	7	0	14	0	7	6	159	2	22	12
9	9	15	12	8	14	16	6	7	13	16	2	8	9	15	0	8	0	169	10	24	4
8	11	16	0	8	12	15	5	9	0	14	0	8	2	14	11	6	14	167	7	23	15
.0	12	17	1	9	11	17	8	9	14	17	0	9	10	17	0	8	2	188	4	26	14
8	9	15	0	8	7	14	12	8	9	14	13	8	12	15	12	6	8	164	10	23	8
9	9	18	4	10	6	18	5	9	2	17	4	10	8	17	0	8	14	191	7	27	6
13	15	24	15	12	7	23	12	12	11	22	1	13	4	24	0	10	5	255	12	36	9
)2	11	159	14	90	12	156	15	86	13	150	11	84	11	152	7	74	3	1,699	14	—	
9	4	16	0	9	1	15	11	8	11	15	1	8	8	15	4	7	7	170	0	24	5

…ff, 7·7 lbs.; and pulped swedes, 50·4 lbs., per head per day.

TABLE XII.—EXPERIMENTS made with COWS, at NEWLANDS

3rd Week.—January 4

—	Cows.	Breed.	Years old.	Dates of Calving.		Weights of the Animals (Dec. 21.)	MONDAY. A.M.		MONDAY. P.M.		TUESDAY. A.M.		TUESDAY. P.M.	
						Lot 1.—Special Food.—Unmalted Barley								
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Shorthorn .	7	May	20	1,066	10	4	6	3	11	4	7	0
	2	Cross Shorthorn .	6	Oct.	26	1,044	19	0	14	5	17	9	14	3
	3	Cross Shorthorn .	Aged	April	25	1,065	16	0	9	1	14	5	9	15
	4	Cross Shorthorn .	7	April	21	1,082	13	11	6	3	13	14	9	7
	5	Cross Shorthorn .	8	Sept.	28	1,020	19	9	9	0	16	12	9	7
	6	Cross Yorkshire .	7	April	14	1,164	12	12	6	14	12	7	7	10
	7	Cross Yorkshire .	10	April	9	1,260	13	0	8	14	13	9	6	0
	8	Cross Ayrshire	5	June	15	944	12	11	7	0	13	7	7	13
	9	Shorthorn	4	June	16	1,156	12	0	6	12	11	6	6	8
	10	Shorthorn . .	7	Oct.	29	1,234	20	10	12	0	23	4	12	8
				Totals .		11,067	149	9	88	4	144	1	91	9
				Averages		1,106	14	15	8	13	14	7	9	2
						Lot 2.—Special Food.—Malt and Malt-dust								
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Yorkshire .	8	March	10	1,184	9	4	6	15	9	1	6	4
	2	Cross Shorthorn	7	Oct.	27	992	16	11	11	10	16	12	9	14
	3	Shorthorn. .	8	April	29	1,260	9	7	4	14	6	4	4	3
	4	Cross Shorthorn .	7	June	19	1,020	10	11	8	5	13	6	7	14
	5	Cross Shorthorn .	6	Oct.	29	914	14	14	8	12	14	15	9	9
	6	Cross Welch . .	8	June	18	1,316	14	10	8	8	16	5	9	1
	7	Cross Shorthorn .	7	June	24	1,008	16	7	8	14	16	4	9	6
	8	Cross Yorkshire .	10	April	26	1,065	14	1	6	6	13	6	9	7
	9	Cross Shorthorn	6	April	18	1,040	16	6	11	6	16	4	9	12
	10	Shorthorn .	9	Nov.	20	1,200	22	6	12	14	23	6	12	12
				Totals .		11,006	143	9	89	15	143	6	96	9
				Averages		1,101	14	6	9	0	14	5	9	11

* Also an allowance, which averaged—rape-cake, 2 lbs.; bean-meal, 2 lbs.; clover-chaff, 14 lbs.;

Rugby. Detailed Record of the Milk yielded, &c.
…ary 10, 1864.

…); 3 lbs. per head per day.*

…day. P.M.		Thursday. A.M.		Thursday. P.M.		Friday. A.M.		Friday. P.M.		Saturday. A.M.		Saturday. P.M.		Sunday. A.M.		Sunday. P.M.		Total in Seven Days.		Per Head Per Day.	
lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
7	6	9	1	7	4	10	0	7	1	8	8	7	9	9	0	8	6	119	4	17	1
14	6	17	12	12	10	18	1	13	5	17	14	13	12	17	8	12	5	219	7	31	6
8	9	14	14	8	7	15	6	8	14	16	0	8	1	15	4	8	12	167	8	23	15
9	3	12	0	9	12	14	2	7	15	12	15	8	12	12	0	9	0	153	15	22	0
11	1	16	2	9	0	15	0	10	8	14	7	10	0	15	2	9	11	179	12	25	1
6	5	12	0	7	8	11	10	6	8	12	2	6	8	11	12	6	11	133	9	19	1
7	10	12	13	8	5	13	11	8	0	13	3	7	14	12	0	7	3	146	3	20	14
6	14	12	7	6	10	12	12	7	11	14	1	6	15	12	8	6	12	139	4	19	14
6	14	11	6	6	10	11	11	6	7	12	0	6	12	12	0	6	5	127	13	18	4
12	4	22	0	12	3	22	12	12	1	22	8	11	2	21	10	9	8	236	7	33	12
90	8	140	7	88	5	145	1	88	6	143	10	87	5	138	12	84	9	1,623	2	—	
9	1	14	1	8	13	14	8	8	13	14	6	8	12	13	14	8	7	162	5	23	3

…3 lbs. Barley (No. 1.), per head per day.*

…day. P.M.		Thursday. A.M.		Thursday. P.M.		Friday. A.M.		Friday. P.M.		Saturday. A.M.		Saturday. P.M.		Sunday. A.M.		Sunday. P.M.		Total in Seven Days.		Per Head Per Day.	
lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
5	10	9	8	5	8	9	12	6	0	9	15	5	2	10	1	4	0	105	15	15	2
9	5	17	0	9	13	16	1	10	4	17	11	9	2	17	6	8	3	188	12	26	15
4	5	6	0	5	5	5	4	4	0	5	10	3	10	5	1	3	4	73	13	10	9
8	3	11	1	7	9	12	14	7	1	13	15	7	2	14	0	6	7	139	4	19	14
7	13	15	2	8	3	14	15	8	6	14	7	8	9	14	7	7	10	162	6	23	3
7	3	14	5	8	12	15	6	8	0	15	14	8	0	15	3	7	8	161	7	23	1
8	15	15	4	9	0	16	9	8	14	16	6	8	9	16	14	8	4	176	4	25	3
7	3	12	0	7	7	13	14	7	0	13	15	6	8	15	8	7	5	148	1	21	2
9	14	17	7	10	2	18	12	9	12	18	0	10	15	16	12	9	6	191	10	27	6
12	3	21	8	12	14	23	0	12	0	22	8	10	10	23	7	11	4	242	14	34	11
80	10	139	13	84	10	147	4	81	5	148	5	78	3	148	11	73	3	1,590	6	—	
8	1	14	0	8	7	14	12	8	2	14	13	7	13	14	14	7	5	159	1	22	12

…aff, 7·7 lbs.; and pulped swedes, 50·4 lbs., per head per day.

TABLE XIII.—EXPERIMENTS made with COWS, at NEWLANDS

4th Week.—January 11

	Cows.	Breed.	Years old.	Date of Calving.		Weights of the Animals Jan. 11	Monday. a.m.		Monday. p.m.		Tuesday. a.m.		Tuesday. p.m.	
Lot 1.—Special Food.—Unmalted Barley														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.*	1	Cross Shorthorn	7	May	29	1,040	10	2	7	12	9	12	[illegible]	[illegible]
	2	Cross Shorthorn .	6	Oct.	26	1,444	16	8	14	3	16	10	13	[illegible]
	3	Cross Shorthorn .	Aged	April	25	1,408	13	10	9	0	10	1	[illegible]	[illegible]
	4	Cross Shorthorn	7	April	21	1,062	11	12	9	3	12	13	[illegible]	[illegible]
	5	Cross Shorthorn .	9	Sept.	28	1,030	15	0	10	0	14	15	[illegible]	[illegible]
	6	Cross Yorkshire .	7	April	14	1,164	11	12	7	8	11	10	7	[illegible]
	7	Cross Yorkshire	10	April	9	1,280	13	2	8	4	13	0	7	[illegible]
	8	Cross Ayrshire .	5	June	15	944	13	12	7	6	14	6	7	[illegible]
	9	Shorthorn . .	4	June	15	1,154	13	5	7	8	13	1	6	[illegible]
	10	Shorthorn .	7	Oct.	29	1,330	21	8	11	8	22	0	11	[illegible]
				Totals .		11,057	143	13	93	4	144	4	[illegible]	[illegible]
				Averages		1,106	14	6	9	6	14	7	[illegible]	[illegible]
Lot 2.—Special Food.—Malt and Malt-dust														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Yorkshire .	9	March	10	1,184	10	1	6	2	9	8	[illegible]	[illegible]
	2	Cross Shorthorn .	7	Oct.	27	892	18	3	9	3	17	12	9	[illegible]
	3	Shorthorn . .	8	April	29	1,260	5	13	6	0	5	11	3	[illegible]
	4	Cross Shorthorn .	7	June	19	1,030	13	0	8	10	12	8	10	[illegible]
	5	Cross Shorthorn	6	Oct.	20	914	15	5	8	4	14	8	7	[illegible]
	6	Cross Welch . .	8	June	18	1,316	15	0	8	0	14	7	9	[illegible]
	7	Cross Shorthorn .	7	June	24	1,006	17	0	9	13	17	10	9	[illegible]
	8	Cross Yorkshire .	10	April	26	1,045	14	10	9	4	15	4	[illegible]	[illegible]
	9	Cross Shorthorn .	6	April	19	1,040	17	10	10	0	17	12	10	[illegible]
	10	Shorthorn . .	8	Nov.	20	1,206	23	0	13	1	23	8	12	[illegible]
				Totals .		11,005	150	1	86	8	147	0	[illegible]	[illegible]
				Averages		1,101	15	0	8	9	14	11	[illegible]	[illegible]

* Also an allowance, which averaged—rape-cake, 3 lbs.; bean-meal, 2 lbs.; clover-chaff, 14 lbs.;

, RUGBY. DETAILED RECORD of the MILK YIELDED, &c.
uary 17, 1864.

.; 3 lbs. per head per day.*

[WEDNES]DAY.		THURSDAY.		FRIDAY.		SATURDAY.		SUNDAY.		Total in Seven Days.	Per Head per Day.
	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.		
.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
	7 14	9 10	7 8	10 9	7 6	9 8	7 14	9 0	7 2	121 14	17 7
	12 14	17 8	13 6	17 8	13 4	17 6	14 12	17 4	13 4	213 15	30 9
5	9 2	16 0	8 14	16 8	8 5	15 14	9 7	16 0	8 11	173 6	24 12
5	9 0	13 6	8 6	13 0	8 8	12 6	10 3	12 4	9 2	150 14	21 9
3	10 10	13 0	10 15	15 2	9 12	15 9	9 14	14 6	9 7	170 14	24 7
10	6 10	13 15	7 8	13 6	7 2	12 10	7 15	13 12	7 7	139 15	20 0
9	7 13	13 8	7 14	13 12	7 5	13 1	7 15	14 6	6 13	147 9	21 1
13	7 8	14 10	8 1	15 1	8 1	13 7	7 15	14 10	7 0	154 4	22 1
14	7 0	12 9	6 14	13 5	6 9	12 13	7 3	12 6	5 12	137 13	19 11
4	11 10	21 10	11 10	23 0	11 14	21 14	11 6	22 6	12 6	237 0	33 14
5	90 1	145 12	91 0	151 3	88 2	144 8	94 8	146 6	87 0	1,647 8	—
5	9 0	14 9	9 2	15 2	8 13	14 7	9 7	14 10	8 11	164 12	23 9

. 3 lbs. Barley (No. 1.), per head per day.*

ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
6	5 4	10 0	3 12	10 9	5 10	9 13	5 10	10 3	4 9	105 15	15 2
13	9 5	17 4	9 10	17 8	9 3	17 4	9 14	18 4	8 4	189 7	27 1
6	4 0	3 6	3 2	4 6	3 0	4 4	2 10	2 9	3 0	53 0	7 9
1	7 0	14 5	7 2	12 6	8 14	11 12	8 1	12 0	7 10	145 6	20 12
9	7 12	15 0	9 10	13 15	7 12	12 4	7 4	12 13	6 6	151 0	21 9
13	8 4	14 6	9 11	14 7	8 4	14 6	8 1	16 0	7 14	161 3	23 0
9	9 3	17 0	10 0	17 15	9 12	18 8	10 2	18 8	10 4	192 11	27 8
4	7 14	14 2	7 14	15 4	8 4	14 10	8 0	14 7	8 0	161 9	23 1
9	9 9	18 0	10 4	17 12	10 9	18 1	18 1	10 3	20 0	197 5	28 3
6	12 9	21 11	11 7	21 0	11 5	20 8	12 1	22 0	12 6	238 2	34 0
11	80 12	142 9	82 8	145 2	82 14	141 6	81 14	146 9	78 5	1,595 10	—
9	8 1	14 4	8 4	14 8	8 5	14 2	8 3	14 11	7 13	159 9	22 13

.chaff, 7·7 lbs.; and pulped swedes, 50·4 lbs., per head per day.

TABLE XIV.—EXPERIMENTS made with COWS, at NEWLANDS

5th Week.—January 18 &c.

—	Cows.	Breed.	Years old.	Date of Calving.		Weights of the Animals (Jan. 16).	Monday. A.M.		Monday. P.M.		Tuesday. A.M.		Tuesday. P.M.	
Lot 1.—Special Food.—Unmalted Barley														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Shorthorn .	7	May	26	1,134	11	0	7	12	8	14	7	12
	2	Cross Shorthorn	6	Oct.	26	1,112	17	8	13	13	16	10	14	12
	3	Cross Shorthorn .	Aged	April	26	1,127	15	6	8	9	16	6	9	1
	4	Cross Shorthorn .	7	April	21	1,125	11	4	8	7	12	12	8	0
	5	Cross Shorthorn .	8	Sept.	26	994	14	2	9	7	15	9	10	9
	6	Cross Yorkshire .	7	April	14	1,242	12	14	7	9	13	10	7	11
	7	Cross Yorkshire .	10	April	9	1,294	12	14	7	10	12	3	8	1
	8	Cross Ayrshire .	6	June	15	954	14	3	7	11	14	12	7	10
	9	Shorthorn . .	4	June	16	1,198	12	11	6	8	12	14	6	6
	10	Shorthorn .	7	Oct.	29	1,312	22	3	11	6	22	8	11	1
				Totals .		11,452	147	1	87	13	146	8	90	[illegible]
				Averages		1,145	14	11	8	13	14	10	9	[illegible]
Lot 2.—Special Food.—Malt and Malt-dust														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Yorkshire .	8	March	10	1,216	10	4	5	10	9	11	5	11
	2	Cross Shorthorn .	7	Oct.	27	1,024	17	12	8	6	17	13	9	4
	3	Shorthorn . .	6	April	29	1,336	3	7	2	9	3	11	3	4
	4	Cross Shorthorn .	7	June	19	1,047	13	5	9	14	13	6	7	15
	5	Cross Shorthorn .	6	Oct.	29	942	11	6	7	8	11	6	9	1
	6	Cross Welch .	8	June	18	1,406	14	6	8	1	14	5	7	10
	7	Cross Shorthorn .	7	June	24	1,076	17	2	9	9	18	6	10	6
	8	Cross Yorkshire	10	April	26	1,132	14	2	7	8	14	3	6	13
	9	Cross Shorthorn .	6	April	19	1,096	17	2	10	6	17	3	11	2
	10	Shorthorn . .	9	Nov.	20	1,237	23	2	11	1	21	0	11	11
				Totals .		11,508	141	1	79	9	140	8	82	14
				Averages		1,151	14	2	7	15	14	1	8	4

* Also an allowance, which averaged—rape-cake, 2 lbs.; bean-meal, 2 lbs.; clover-chaff, 14 lbs.;

Rugby. Detailed Record of the Milk yielded, &c.
ary 24, 1864.

); 3 lbs. per head per day.*

sday.		Thursday.				Friday.				Saturday.				Sunday.				Total in Seven Days.		Per Head per Day.	
P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.		A.M.		P.M.					
lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
7	3	8	12	8	3	10	6	7	2	11	4	7	3	11	0	7	1	123	8	17	10
13	11	17	4	13	10	18	1	13	0	18	5	13	8	17	10	13	0	219	0	31	5
8	13	16	6	9	13	16	10	9	5	16	4	9	3	17	2	8	14	177	6	25	5
9	0	13	3	8	12	13	6	8	3	13	10	8	8	13	8	7	14	153	5	21	14
8	0	16	2	9	5	15	0	10	3	13	6	10	10	15	4	9	10	170	10	24	6
7	8	12	14	7	13	13	6	7	11	13	11	7	4	13	0	6	13	145	3	20	12
7	12	12	14	8	11	11	5	8	12	13	10	7	3	13	0	7	11	146	1	20	14
7	8	14	4	7	12	14	12	7	14	14	4	8	1	14	12	7	0	155	2	22	3
6	8	11	6	7	6	11	4	6	12	11	1	6	11	11	10	5	12	128	3	18	5
12	8	21	2	12	8	21	10	13	4	21	10	12	5	21	0	10	14	235	7	33	10
88	7	144	3	93	3	145	12	92	2	147	1	90	8	147	14	84	9	1,653	13	—	
8	14	14	7	9	5	14	9	9	3	14	11	9	1	14	13	8	7	165	6	23	10

3 lbs. Barley (No. 1.), per head per day.*

lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
5	10	9	10	5	10	10	6	5	13	9	4	5	9	9	0	5	9	108	0	15	7
9	14	17	9	9	6	17	6	9	13	16	9	10	6	17	6	9	2	188	7	26	15
3	0	2	4	2	3	2	2	2	0	2	3	2	0	2	0	1	6	35	6	5	1
7	5	14	12	7	2	13	11	8	14	12	6	8	1	14	4	6	8	150	0	21	7
8	4	13	2	8	1	13	12	7	12	14	1	7	10	13	2	8	0	147	2	21	0
7	4	14	14	8	4	14	1	7	13	13	14	8	4	13	14	8	10	157	3	22	7
9	5	16	11	10	5	16	4	7	12	15	10	8	3	16	2	9	0	180	12	25	13
7	6	14	0	8	0	13	11	9	1	13	10	8	14	12	13	6	10	151	6	21	10
11	4	18	1	11	9	17	11	11	3	18	6	9	7	18	12	10	15	201	11	28	13
11	0	19	0	11	0	19	14	10	10	18	1	10	7	19	8	11	0	216	10	30	15
80	4	139	15	81	8	138	14	80	11	134	0	78	13	136	13	76	12	1,536	9	—	
8	0	14	0	8	2	13	14	8	1	13	6	7	14	13	11	7	11	153	10	21	15

aff, 7·7 lbs.; and pulped swedes, 50·4 lbs., per head per day.

TABLE XV.—EXPERIMENTS made with COWS, at NEWLANDS

6th Week.—January 25

—	Cows.	Breed.	Years old.	Dates of Calving.		Weights of the Animals (Jan. 14.)	MONDAY. a.m.		MONDAY. p.m.		TUESDAY. a.m.		TUESDAY. p.m.	
Lot 1.—Special Food.—Unmalted Barley														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Shorthorn	7	May	20	1,134	11	0	7	0	10	0	6	8
	2	Cross Shorthorn	6	Oct.	26	1,113	14	12	12	6	17	8	13	6
	3	Cross Shorthorn .	Aged	April	26	1,127	16	0	9	14	16	3	9	4
	4	Cross Shorthorn .	7	April	21	1,125	13	1	8	10	14	2	4	10
	5	Cross Shorthorn	8	Sept.	26	994	14	14	9	10	13	10	11	1
	6	Cross Yorkshire .	7	April	14	1,343	12	3	7	10	12	13	7	12
	7	Cross Yorkshire	10	April	9	1,364	13	12	7	3	13	6	7	10
	8	Cross Ayrshire .	6	June	15	964	14	11	6	12	14	0	8	6
	9	Shorthorn	4	June	16	1,198	11	4	6	3	11	6	7	0
	10	Shorthorn	7	Oct.	20	1,212	22	14	12	0	22	0	13	9
				Totals .		11,482	149	3	87	3	145	5	94	3
				Averages		1,148	14	15	8	11	14	8	9	7
Lot 2.—Special Food.—Malt and Malt-dust														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Yorkshire .	8	March	10	1,216	10	1	5	0	9	11	4	8
	2	Cross Shorthorn .	7	Oct.	27	1,024	17	6	8	12	17	0	10	0
	3	Shorthorn . .	8	April	29	1,336	3	6	2	0	2	1	1	2
	4	Cross Shorthorn .	7	June	19	1,047	13	0	9	0	12	3	8	10
	5	Cross Shorthorn .	8	Oct.	29	942	14	0	7	12	14	0	7	10
	6	Cross Welsh . .	8	June	13	1,400	15	2	7	6	14	6	9	11
	7	Cross Shorthorn .	7	June	24	1,074	16	2	8	4	16	0	9	12
	8	Cross Yorkshire .	10	April	26	1,132	12	8	6	15	11	12	6	12
	9	Cross Shorthorn .	4	April	19	1,090	18	10	9	10	18	2	11	8
	10	Shorthorn .	9	Nov.	20	1,237	17	0	9	3	17	14	11	4
				Totals .		11,508	135	4	73	14	133	6	84	3
				Averages		1,151	13	10	7	6	[illegible]	5	8	7

* Also an allowance, which averaged—rape-cake, 2 lbs.; bean-meal, 2 lbs.; clover-chaff, 14 lbs.;

, Rugby. Detailed Record of the Milk yielded, &c.
uary 31, 1864.

).; 3 lbs. per head per day.*

[...]day. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Total in Seven Days.	Per Head per Day.
lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
8 10	10 0	8 15	11 0	8 1	10 0	7 12	9 11	6 10	128 9	18 6
12 10	17 3	13 4	17 13	13 13	18 6	12 8	18 0	9 0	212 13	30 6
9 0	16 11	8 12	16 7	10 1	16 6	8 12	16 4	7 11	178 4	25 7
9 6	14 0	8 4	12 13	9 7	13 7	8 13	13 0	7 3	153 14	22 0
9 6	14 6	9 12	14 2	9 1	13 6	9 5	14 12	8 2	166 7	23 12
7 2	15 5	7 4	11 8	8 0	12 11	7 4	12 0	6 2	140 5	20 1
7 10	13 8	6 10	12 0	7 12	12 5	7 2	11 10	6 12	140 1	20 0
8 0	14 15	7 12	14 12	8 6	15 11	7 0	14 2	6 11	156 9	22 6
8 0	12 6	6 3	11 12	6 8	12 1	5 10	12 8	5 9	127 14	18 4
12 4	21 0	11 2	21 2	12 0	20 0	10 8	19 4	7 14	226 12	32 6
92 0	149 6	87 14	143 5	93 1	144 5	84 10	141 3	71 10	1,631 8	—
9 3	14 15	8 13	14 5	9 5	14 7	8 7	14 2	7 3	163 2	23 5

3 lbs. Barley (No. 1.), per head per day.*

[...]day. P.M.	Thursday. A.M.	Thursday. P.M.	Friday. A.M.	Friday. P.M.	Saturday. A.M.	Saturday. P.M.	Sunday. A.M.	Sunday. P.M.	Total in Seven Days.	Per Head per Day.
lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
6 2	9 14	6 3	10 2	5 14	10 2	5 10	9 12	5 2	109 14	15 11
9 10	16 9	10 2	17 9	9 12	18 0	9 6	16 10	8 4	187 1	26 12
1 10	2 0	1 5	1 8	1 6	1 5	1 0	1 2	0 10	21 8	3 1
7 6	12 5	7 7	13 0	7 3	12 6	8 11	12 4	7 4	142 14	20 7
8 0	13 11	8 0	14 0	8 12	14 1	7 0	13 14	7 0	151 8	21 10
8 10	15 4	7 12	14 10	8 6	15 2	8 3	14 0	8 0	161 8	23 1
10 2	17 6	9 4	18 0	9 10	17 10	8 10	16 2	9 0	183 8	26 3
6 4	13 0	6 9	12 6	8 4	12 10	9 0	14 0	7 0	141 3	20 3
11 0	18 2	10 13	17 12	11 6	18 12	10 10	19 2	10 6	203 8	29 1
10 7	21 9	10 4	19 0	9 6	17 9	10 5	18 2	9 6	201 1	28 12
79 3	139 12	77 11	137 15	79 15	137 9	78 7	135 0	72 0	1,503 9	—
7 15	14 0	7 12	13 13	8 0	13 12	7 13	13 8	7 3	150 6	21 8

-chaff, 7·7 lbs.; and pulped swedes, 50·4 lbs., per head per day.

TABLE XVI.—EXPERIMENTS made with COWS, at NEWLANDS

7th Week.—February 1

	Cows.	Breed.	Years old.	Dates of Calving.		Weights of the Animals (Jan. 18.)	MONDAY. A.M.		MONDAY. P.M.		TUESDAY. A.M.		TUESDAY. P.M.	
Lot 1.—Special Food.—Unmalted Barley														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Shorthorn .	7	May	20	1,134	11	0	7	1	10	2	7	12
	2	Cross Shorthorn .	6	Oct.	26	1,112	18	0	12	8	18	0	12	15
	3	Cross Shorthorn .	Aged.	April	26	1,127	16	4	8	13	17	0	9	8
	4	Cross Shorthorn .	7	April	21	1,125	12	10	8	12	14	1	8	5
	5	Cross Shorthorn .	8	Sept.	26	994	13	12	9	4	13	0	10	1
	6	Cross Yorkshire .	7	April	14	1,242	13	0	7	7	11	4	7	4
	7	Cross Yorkshire .	10	April	9	1,284	12	6	7	6	13	7	8	8
	8	Cross Ayrshire .	5	June	15	954	15	2	7	4	15	8	8	0
	9	Shorthorn . .	4	June	15	1,198	10	7	6	13	12	0	7	2
	10	Shorthorn . .	7	Oct.	29	1,312	17	4	9	10	20	2	11	12
				Totals .		11,482	140	5	84	14	144	8	90	11
				Averages		1,148	14	0	8	8	14	7	9	1
Lot 2.—Special Food.—Malt and Malt-dust														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Yorkshire .	8	March	10	1,216	10	2	5	12	10	0	6	3
	2	Cross Shorthorn .	7	Oct.	27	1,024	18	6	9	10	18	12	9	6
	3	Shorthorn . .	8	April	29	1,336	1	8	0	11	1	6	0	15
	4	Cross Shorthorn .	7	June	19	1,047	10	10	7	13	12	5	7	14
	5	Cross Shorthorn .	6	Oct.	29	942	14	10	8	10	14	2	8	1
	6	Cross Welch . .	8	June	18	1,400	15	7	8	0	14	10	9	8
	7	Cross Shorthorn .	7	June	24	1,076	17	10	9	1	17	5	10	4
	8	Cross Yorkshire .	10	April	26	1,132	14	4	7	12	13	14	7	12
	9	Cross Shorthorn .	6	April	19	1,098	18	4	11	2	18	1	10	2
	10	Shorthorn . .	9	Nov.	20	1,237	18	0	11	13	19	4	11	6
				Totals .		11,508	138	13	80	4	139	11	80	14
				Averages		1,151	13	14	8	0	13	15	8	1

* Also an allowance, which averaged—rape-cake, 2 lbs.; bean-meal, 2 lbs.; clover-chaff, 14 lbs.;

, RUGBY. DETAILED RECORD of the MILK YIELDED, &c.
bruary 7, 1864.

l.); 3 lbs. per head per day.*

SDAY. P.M.	THURSDAY. A.M.	THURSDAY. P.M.	FRIDAY. A.M.	FRIDAY. P.M.	SATURDAY. A.M.	SATURDAY. P.M.	SUNDAY. A.M.	SUNDAY. P.M.	Total in Seven Days.	Per Head per Day.
lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
9 3	10 0	7 0	9 14	8 4	11 3	7 4	12 1	6 9	126 5	18 1
14 8	17 10	13 7	18 1	14 2	17 6	14 14	19 4	10 7	218 11	31 4
9 3	16 2	8 13	16 12	10 0	16 5	9 1	17 12	7 13	179 9	25 10
8 11	12 13	9 3	13 10	9 1	13 10	8 13	14 4	6 12	153 12	21 15
10 7	14 6	10 3	15 11	9 14	15 6	9 4	17 0	8 6	169 4	24 3
7 3	13 4	7 2	13 14	7 12	12 12	7 6	13 12	6 0	139 13	20 0
7 4	12 10	7 7	13 1	8 5	13 6	8 0	13 0	7 2	145 4	20 12
8 12	15 8	8 4	16 0	7 12	15 10	8 14	17 0	8 2	166 12	23 13
6 7	11 15	6 2	11 6	7 0	11 12	6 3	12 4	5 10	126 15	18 2
11 5	21 12	11 2	22 0	10 12	20 10	10 13	21 12	7 15	218 1	31 2
92 15	146 0	88 11	150 5	92 14	148 0	90 8	158 1	74 12	1,644 6	—
9 5	14 9	8 14	15 0	9 5	14 13	9 1	15 13	7 8	164 7	23 8

3 lbs. Barley (No. 1.), per head per day.*

SDAY. P.M.	THURSDAY. A.M.	THURSDAY. P.M.	FRIDAY. A.M.	FRIDAY. P.M.	SATURDAY. A.M.	SATURDAY. P.M.	SUNDAY. A.M.	SUNDAY. P.M.	Total in Seven Days.	Per Head per Day.
lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
6 4	9 6	5 12	9 12	5 14	10 4	5 8	10 4	4 6	108 8	15 8
10 2	16 0	10 10	17 0	9 8	16 12	9 0	16 14	8 4	187 0	26 11
0 10	1 0	1 3	1 0	0 7	1 0	0 7	1 2	1 0	13 10	1 15
7 11	12 15	6 8	13 8	7 7	12 4	7 6	14 12	7 0	140 5	20 1
9 0	13 4	7 8	13 2	8 1	12 0	6 15	14 0	6 11	150 0	21 7
8 8	14 10	10 2	12 12	8 2	15 0	7 6	16 0	7 1	161 1	23 0
10 6	17 5	7 6	17 3	9 15	17 6	9 10	17 4	8 10	186 13	26 11
8 2	13 7	7 3	13 6	8 6	11 12	7 12	12 13	7 0	147 13	21 2
11 12	18 2	11 2	19 3	10 11	19 9	10 9	18 3	9 10	207 7	29 3
10 10	20 4	11 12	20 1	10 11	19 0	10 5	17 5	9 6	210 1	30 0
83 1	136 5	79 5	136 15	79 2	134 15	74 14	138 9	69 0	1,509 10	—
8 5	13 10	7 15	13 11	7 15	13 8	7 8	13 14	6 14	150 15	21 9

-chaff, 7·7 lbs.; and pulped swedes, 50·4 lbs., per head per day.

TABLE XVII.—EXPERIMENTS made with COWS, at NEWLANDS

5th Week.—February 8

	Cows.	Breed.	Years old.	Time of Calving.		Weights of the Animals Jan. [illegible]	Monday. A.M.		Monday. P.M.		Tuesday. A.M.		Tuesday. P.M.	
Lot 1.—Special Food.—Unmalted Barley														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Shorthorn	[illegible]	May	20	[illegible]	[illegible]	6	6	7	[illegible]	0	7	5
	2	Cross Shorthorn .	4	Oct.	[illegible]	[illegible]	[illegible]	[illegible]	14	3	17	6	13	7
	3	Cross Shorthorn .	Aged	April	26	[illegible]	15	2	9	12	15	14	9	4
	4	Cross Shorthorn .	7	April	[illegible]	[illegible]	14	4	7	12	15	0	7	14
	5	Cross Shorthorn .	[illegible]	Sept.	28	984	15	1	10	0	14	12	9	6
	6	Cross Yorkshire .	7	April	24	1,362	13	0	7	2	12	3	7	6
	7	Cross Yorkshire .	10	April	9	1,284	[illegible]	0	9	0	13	0	7	13
	8	Cross Ayrshire .	5	June	15	963	17	0	9	10	16	10	9	0
	9	Shorthorn . .	4	June	15	[illegible]	[illegible]	7	6	7	12	9	6	13
	10	Shorthorn . .	7	Oct.	29	1,322	20	13	12	0	20	1	11	10
				Totals .		11,492	146	12	89	5	145	7	89	13
				Averages		1,149	14	11	8	15	14	14	8	14
Lot 2.—Special Food.—Malt and Malt-dust														
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Yorkshire .	9	March	10	1,216	11	1	5	6	10	7	5	0
	2	Cross Shorthorn .	7	Oct.	27	1,024	17	10	10	0	18	0	9	14
	3	Shorthorn . .	8	April	29	1,336	1	0	0	15	0	13	0	14
	4	Cross Shorthorn .	7	June	19	1,047	12	1	7	0	12	12	7	0
	5	Cross Shorthorn .	6	Oct.	29	942	14	10	6	12	11	13	7	10
	6	Cross Welch . .	8	June	18	1,400	14	11	8	5	15	0	8	15
	7	Cross Shorthorn .	7	June	24	1,076	17	0	7	13	16	9	7	8
	8	Cross Yorkshire .	10	April	26	1,132	13	11	6	12	12	2	8	4
	9	Cross Shorthorn .	6	April	19	1,098	18	6	10	8	18	4	10	0
	10	Shorthorn . .	9	Nov.	20	1,237	18	14	9	8	18	2	10	13
				Totals . .		11,508	139	0	72	15	133	14	76	14
				Averages		1,151	13	14	7	5	13	6	7	11

* Also an allowance, which averaged—rape-cake, 2 lbs.; bean-meal, 2 lbs.; clover-chaff, 14 lbs.;

rm, Rugby. Detailed Record of the Milk yielded, &c.
February 14, 1864.

No. 1.); 3 lbs. per head per day.*

Wednesday A.M. ozs.	Wednesday P.M. lbs.	ozs.	Thursday A.M. lbs.	ozs.	Thursday P.M. lbs.	ozs.	Friday A.M. lbs.	ozs.	Friday P.M. lbs.	ozs.	Saturday A.M. lbs.	ozs.	Saturday P.M. lbs.	ozs.	Sunday A.M. lbs.	ozs.	Sunday P.M. lbs.	ozs.	Total in Seven Days lbs.	ozs.	Per Head per Day lbs.	ozs.
10	7	11	10	0	8	4	11	0	8	13	11	9	7	12	12	0	6	0	129	7	18	8
3	14	4	17	15	13	2	17	2	14	4	17	5	14	2	19	0	11	15	219	5	31	5
0	10	2	15	6	9	4	16	3	9	12	16	4	9	5	16	12	8	8	176	8	25	3
5	8	12	12	3	9	6	12	10	8	7	12	8	9	8	14	1	8	2	153	12	21	15
6	9	5	16	0	10	2	15	10	9	10	15	2	10	4	16	0	8	12	175	6	25	1
7	7	5	11	14	7	11	11	3	7	0	12	5	7	5	14	4	6	12	138	2	19	12
0	7	0	12	5	8	0	12	10	8	2	12	15	8	0	15	0	6	12	143	8	20	8
0	7	3	15	0	8	11	14	5	8	2	14	7	8	4	16	2	7	10	166	0	23	11
8	6	0	11	8	6	7	11	0	5	14	12	8	6	10	11	2	5	5	125	2	17	14
7	11	4	19	12	12	4	20	0	11	3	20	7	11	7	20	8	9	4	221	0	31	9
14	88	14	141	15	93	3	142	0	91	3	145	6	92	9	154	13	79	0	1,648	2	—	
9	8	14	14	3	9	5	14	3	9	2	14	9	9	4	15	8	7	14	164	17	23	9

3 lbs. Barley (No. 1.), per head per day.*

Wednesday A.M. ozs.	Wednesday P.M. lbs.	ozs.	Thursday A.M. lbs.	ozs.	Thursday P.M. lbs.	ozs.	Friday A.M. lbs.	ozs.	Friday P.M. lbs.	ozs.	Saturday A.M. lbs.	ozs.	Saturday P.M. lbs.	ozs.	Sunday A.M. lbs.	ozs.	Sunday P.M. lbs.	ozs.	Total in Seven Days lbs.	ozs.	Per Head per Day lbs.	ozs.
0	5	14	9	8	5	10	9	11	6	0	9	4	5	11	10	6	5	11	110	1	15	12
0	10	0	17	6	9	6	17	10	10	8	17	1	10	8	17	6	8	2	191	7	27	6
13	0	12	0	12	0	10	0	13	0	10	0	10	0	8	0	7	—		9	9	1	6
0	8	2	13	0	6	12	11	9	9	10	12	7	8	8	12	7	9	10	143	6	20	8
8	7	0	12	18	7	2	12	4	7	7	12	12	8	5	14	1	6	0	141	1	20	2
4	8	3	13	12	7	12	14	7	8	0	14	4	8	6	14	4	7	10	158	13	22	11
4	9	3	15	14	9	8	16	15	10	3	17	2	9	5	16	14	8	12	179	14	25	11
2	8	11	11	10	8	2	12	1	8	4	13	4	8	4	12	0	8	2	143	5	20	8
10	10	12	18	5	10	8	18	12	10	14	19	0	11	12	20	12	10	8	205	15	29	7
8	9	0	18	0	11	8	18	0	11	10	18	8	10	4	19	6	8	14	201	15	28	14
1	77	9	131	0	76	14	132	2	83	2	134	4	81	7	137	15	73	5	1,485	6	—	
8	7	12	13	2	7	11	13	4	8	5	13	7	8	2	13	13	7	5	148	9	21	3

w-chaff, 7·7 lbs.; and pulped swedes, 50·4 lbs., per head per day.

Table XVIII.—Experiments made with COWS, at Newl

9th Week.—Februa

Lot 1.—Special Food.—Unmalted

—	Cows.	Breed.	Years old.	Dates of Calving.		Weights of the Animals (Feb. 15.)	Monday. A.M.		Monday. P.M.		Tuesd. A.M.	
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Shorthorn .	7	May	20	1,116	12	0	8	6	11	4
	2	Cross Shorthorn .	6	Oct.	26	1,095	18	0	14	0	17	6
	3	Cross Shorthorn .	Aged	April	26	1,132	16	10	9	2	16	10
	4	Cross Shorthorn .	7	April	21	1,144	14	0	9	3	12	5
	5	Cross Shorthorn .	8	Sept.	26	1,016	14	11	10	10	15	0
	6	Cross Yorkshire .	7	April	14	1,280	12	0	7	6	12	12
	7	Cross Yorkshire .	10	April	9	1,300	13	8	7	0	12	0
	8	Cross Ayrshire .	5	June	15	964	16	2	8	8	15	6
	9	Shorthorn . .	4	June	15	1,239	11	12	5	10	11	0
	10	Shorthorn . .	7	Oct.	29	1,306	21	0	10	11	20	0
				Totals .		11,592	149	11	90	8	143	11
				Averages		1,159	15	0	9	1	14	6

Lot 2.—Special Food.—Malt and Malt

—	Cows.	Breed.	Years old.	Dates of Calving.		Weights of the Animals (Feb. 15.)	Monday. A.M.		Monday. P.M.		Tuesd. A.M.	
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Yorkshire .	8	March	10	1,288	9	2	6	7	9	0
	2	Cross Shorthorn .	7	Oct.	27	1,026	18	0	10	3	17	2
	3	Shorthorn . .	8	April	29	1,392	—		1	0	—	
	4	Cross Shorthorn .	7	June	19	1,047	14	2	8	0	11	0
	5	Cross Shorthorn .	6	Oct.	29	934	14	11	8	3	12	1
	6	Cross Welch . .	8	June	18	1,392	15	8	8	15	13	6
	7	Cross Shorthorn .	7	June	24	1,076	18	4	8	5	16	4
	8	Cross Yorkshire .	10	April	26	1,144	13	11	6	8	11	11
	9	Cross Shorthorn .	6	April	19	1,106	19	11	10	14	18	8
	10	Shorthorn . .	9	Nov.	20	1,194	20	4	10	6	19	8
				Totals .		11,597	143	5	78	13	128	8
				Averages		1,160	14	5	7	14	12	14

* Also an allowance, which averaged—rape-cake, 2 lbs.; bean-meal, 2 lbs.; clover-chaff, 14

., **Rugby. Detailed Record** of the **Milk yielded**, &c.
ruary 21, 1864.

1.); 3 lbs. per head per day.*

…sday.		Thursday.		Friday.		Saturday.		Sunday.		Total in Seven Days.	Per Head per Day.
	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.		
s.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
4	8 10	11 0	8 8	11 2	7 10	11 4	8 4	10 12	8 11	136 8	19 8
4	12 12	17 14	13 0	17 10	12 10	16 3	14 8	16 0	11 6	212 13	30 6
8	9 3	15 15	9 1	15 4	9 10	16 0	9 0	15 2	9 10	175 10	25 1
10	10 2	13 2	9 12	12 1	9 12	12 2	7 14	13 8	7 13	152 4	21 12
3	9 1	15 10	10 1	14 11	10 11	13 11	10 6	15 0	9 13	175 9	25 1
8	7 9	12 8	8 0	12 6	8 3	12 1	8 1	11 8	7 6	139 14	20 0
0	7 4	12 4	8 8	11 12	7 12	12 0	7 13	12 8	6 5	138 5	19 12
3	8 11	16 7	9 6	15 10	9 5	15 8	9 7	15 10	8 12	173 11	24 13
14	6 6	11 3	6 6	10 8	6 6	10 9	5 11	11 4	5 11	119 8	17 1
4	11 0	20 0	11 14	19 14	11 6	19 10	11 2	20 10	9 8	217 11	31 2
4	90 10	145 14	94 8	140 14	93 5	139 0	92 2	141 14	84 15	1,641 13	—
7	9 1	14 9	9 7	14 2	9 5	13 14	9 3	14 3	8 8	164 3	23 7

n 3 lbs. Barley (No. 1.), per head per day.*

ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
3	5 7	8 12	5 8	8 5	5 7	7 11	5 14	8 7	5 5	101 4	14 7
4	10 0	17 6	9 13	16 12	10 6	16 10	10 4	17 8	8 14	190 6	27 3
-	0 8	—	0 6	—	0 4	—	0 5	—	0 3	3 4	0 7
0	8 10	13 0	8 8	13 1	7 10	11 6	9 0	11 8	9 9	146 6	20 15
12	9 6	12 8	8 6	12 0	8 15	11 6	6 13	10 12	7 0	141 9	20 4
6	7 14	15 2	9 10	14 10	9 10	14 4	7 14	15 12	8 8	165 7	23 10
14	9 4	16 8	9 10	16 4	9 8	15 13	9 10	17 6	9 3	181 14	26 0
11	8 0	12 14	7 10	12 2	7 3	12 0	7 14	11 14	6 6	139 7	19 15
8	11 3	19 8	11 0	17 12	10 14	17 12	11 0	16 14	10 0	206 11	29 8
12	10 6	17 10	10 6	16 11	10 14	18 7	9 12	18 7	9 3	203 4	29 1
6	79 10	133 4	80 13	127 9	80 11	125 6	78 6	128 8	74 3	1,479 8	—
	7 15	13 5	8 1	12 12	8 1	12 9	7 13	12 14	7 7	147 15	21 2

chaff, 7·7 lbs.; and pulped swedes, 50·4 lbs., per head per day.

TABLE XIX.—EXPERIMENTS made with COWS, at NEWLANDS

10th Week.—February 22

	Cows.	Breed.	Years old.	Dates of Calving.		Weights of the Animals Feb. 22	MONDAY a.m.		MONDAY p.m.		TUESDAY a.m.		TUESDAY p.m.	
		Lot 1.—Special Food.—Unmalted Barley												
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Shorthorn	7	May	20	1,136	11	3	7	8	11	14	7	8
	2	Cross Shorthorn .	6	Oct.	26	1,111	16	4	14	12	16	12	12	8
	3	Cross Shorthorn .	Aged	April	[illegible]	1,156	14	6	9	13	15	10	9	11
	4	Cross Shorthorn	7	April	21	1,150	13	0	8	6	12	0	9	11
	5	Cross Shorthorn	8	Sept.	26	1,019	13	2	11	2	14	4	5	10
	6	Cross Yorkshire	7	April	14	1,312	12	5	8	2	12	6	7	7
	7	Cross Yorkshire	10	April	9	1,308	13	3	9	15	11	2	7	8
	8	Cross Ayrshire	5	June	15	974	16	11	9	3	15	3	9	8
	9	Shorthorn .	4	June	16	1,253	11	5	6	0	11	0	1	14
	10	Shorthorn .	7	Oct.	29	1,347	21	0	11	8	20	0	10	3
				Totals		11,761	146	7	95	2	140	6	86	[illegible]
				Averages		1,176	14	10	9	8	14	0	8	11
		Lot 2.—Special Food.—Malt and Malt-dust												
	Nos.					lbs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.	lbs.	ozs.
Yield of Milk, &c.	1	Cross Yorkshire .	8	March	10	1,310	8	0	5	14	7	8	5	3
	2	Cross Shorthorn .	7	Oct.	27	1,022	16	1	10	3	16	6	9	9
	3	Shorthorn .	8	April	29	1,428	—		—		—		—	
	4	Cross Shorthorn .	7	June	19	1,066	11	10	9	0	11	8	8	1
	5	Cross Shorthorn .	6	Oct.	29	938	11	12	8	14	10	8	7	8
	6	Cross Welch . .	6	June	18	1,306	14	7	8	2	13	2	7	1
	7	Cross Shorthorn .	7	June	24	1,076	17	12	9	6	16	3	10	1
	8	Cross Yorkshire .	10	April	26	1,179	11	8	7	7	11	5	7	2
	9	Cross Shorthorn .	6	April	19	1,092	16	9	9	1	16	8	9	8
	10	Shorthorn . .	9	Nov	20	1,214	17	8	10	6	17	12	10	6
				Totals		11 719	127	4	78	8	116	13	12	8
				Averages		1,172	15	12	7	8	11	14	7	8

* Also an allowance, which averaged—rape-cake, 2 lbs.; bean-meal, 2 lbs.; clover-chaff, 14 lbs.

'ARM, RUGBY. DETAILED RECORD of the MILK YIELDED, &c.
› February 28, 1864.

No. 1.) ; 3 lbs. per head per day.*

WEDNESDAY. A.M.	WEDNESDAY. P.M.	THURSDAY. A.M.	THURSDAY. P.M.	FRIDAY. A.M.	FRIDAY. P.M.	SATURDAY. A.M.	SATURDAY. P.M.	SUNDAY. A.M.	SUNDAY. P.M.	Total in Seven Days.	Per Head per Day.
bs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
11 0	7 4	11 12	7 10	11 0	7 12	11 2	8 2	11 8	7 10	132 5	18 14
17 6	13 14	17 2	15 5	18 1	12 0	17 10	12 10	18 4	11 9	217 3	31 0
16 2	9 6	16 4	9 0	14 12	8 7	16 11	9 2	17 0	8 9	175 14	25 2
13 0	8 7	13 0	8 9	12 3	8 2	13 13	8 8	13 4	8 2	149 1	21 5
15 0	9 13	15 8	9 10	15 5	9 2	15 12	11 0	15 12	10 2	174 2	24 14
12 12	7 12	12 6	7 6	11 12	7 14	12 2	7 4	13 3	7 0	139 11	19 15
12 6	7 6	11 10	7 9	12 1	6 14	12 6	7 2	13 0	5 2	136 7	19 8
15 8	9 2	16 0	9 2	16 3	9 0	15 12	7 13	14 4	7 9	170 8	24 6
11 3	5 12	10 14	6 10	10 6	5 3	10 12	5 14	11 6	5 3	117 6	16 12
20 3	11 8	19 8	11 7	20 0	11 0	20 3	10 12	19 12	10 12	217 11	31 2
144 8	90 6	144 0	92 4	141 11	85 6	146 3	88 3	147 5	81 10	1,630 4	—
14 7	9 1	14 6	9 3	14 3	8 9	14 10	8 13	14 12	8 3	163 0	23 5

from 3 lbs Barley (No. 1.), per head per day.*

WEDNESDAY. A.M.	WEDNESDAY. P.M.	THURSDAY. A.M.	THURSDAY. P.M.	FRIDAY. A.M.	FRIDAY. P.M.	SATURDAY. A.M.	SATURDAY. P.M.	SUNDAY. A.M.	SUNDAY. P.M.	Total in Seven Days.	Per Head per Day.
lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
8 4	4 12	8 4	4 11	7 5	4 10	8 4	5 6	8 6	4 0	89 14	12 13
16 0	9 6	16 10	9 12	16 0	9 0	17 0	10 11	17 4	10 6	186 1	26 9
—	—	—	—	—	—	—	—	—	—	—	—
12 0	6 14	12 1	8 2	11 4	7 13	11 4	7 8	13 0	7 0	135 9	19 6
11 12	7 11	12 6	8 0	11 0	7 1	11 6	7 2	13 8	6 11	132 5	18 14
14 4	8 0	14 2	8 10	14 2	7 3	14 8	8 12	15 4	7 0	154 10	22 1
16 12	9 2	16 11	10 3	16 3	8 8	17 6	9 12	18 0	8 0	183 14	26 4
3 0	6 13	12 8	8 0	11 4	6 4	12 2	7 11	13 4	6 8	134 13	19 4
13	9 11	17 3	10 13	16 12	10 2	17 8	11 6	18 10	10 14	190 6	27 3
10	10 2	18 5	10 13	18 3	9 10	17 6	10 9	17 1	9 7	195 0	27 14
7	72 7	128 2	79 0	122 1	70 3	126 12	78 13	134 5	69 14	1,402 8	—
10	7 4	12 13	7 14	12 3	7 0	12 11	7 14	13 7	7 0	140 4	20 1

aw-chaff, 7·7 lbs. ; and pulped swedes, 50·4 lbs., per head per day.

Table XX.—Experiments made with COWS, at Newlands Farm, Rugby.

Per-centage of Cream as shown by the Lactometer, in the mixed Milk of the 10 Cows in each Case.

Dates.	Cows.	Special Food.	Per Cent. Cream.		
			Morning.	Afternoon.	Mean.
1863: Dec. 20.	Lot 1. .	(Before giving Special Food) . .	9¾	12½	11⅛
	Lot 2. .	Do. Do.	9¼	12	10⅝
,, Dec. 29.	Lot 1. .	Unmalted Barley .	12	13	12½
	Lot 2. .	Malted Barley . .	10	12	11
1864: Jan. 5.	Lot 1. .	Unmalted Barley . .	12	14½	13¼
	Lot 2. .	Malted Barley . .	10½	13	11¾
,, Jan. 12.	Lot 1. .	Unmalted Barley .	11¼	14¼	12¾
	Lot 2. .	Malted Barley . .	10	13½	11¾
,, Jan. 19.	Lot 1. .	Unmalted Barley .	10¾	13¾	12¼
	Lot 2. .	Malted Barley . .	10	13	11½
,, Jan. 26.	Lot 1. .	Unmalted Barley .	12	14	13
	Lot 2. .	Malted Barley . .	10	11½	10¾
,, Feb. 2.	Lot 1. .	Unmalted Barley .	11	12½	11¾
	Lot 2. .	Malted Barley . .	9½	10½	10
,, Feb. 9.	Lot 1. .	Unmalted Barley .	11½	13½	12½
	Lot 2. .	Malted Barley . .	10	12	11
,, Feb. 16.	Lot 1. .	Unmalted Barley .	12	14½	13¼
	Lot 2. .	Malted Barley . .	11	13	12
,, Feb. 23.	Lot 1. .	Unmalted Barley .	12	13½	12¾
	Lot 2. .	Malted Barley . .	11	12½	11¾

SUMMARY.

Dec. 29, 1863, to Feb. 23, 1864	Lot 1. .	Unmalted Barley .	11½	13¾	12⅝
	Lot 2. .	Malted Barley . .	10¼	12⅜	11¼

	…ood consumed.				Cows.	Weights. Increase (or Loss) in Live-weight and Milk.						
						Weights.		Increase (or Loss) in Live-weight.		Milk yielded.		
	Total in 4 Weeks.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.	To produce 100 lbs. Milk.		Dec. 21, 1863.	Jan. 18, 1864.	Total in 4 Weeks.	Per 1000 lbs. Live-weight per Week.	Total in 4 Weeks.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.
Lot 1.—10 Cows; Special Food—Unmalted Barley "No. 1."												
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,086	1,134	48		534¼	19·1	
					2	1,044	1,112	68		891½	31·8	
					3	1,065	1,127	62		694	24·8	
					4	1,082	1,125	43		624¾	22·3	
Barley, unmalted	840	3·0	18·6	12·3	5	1,020	994	—26		724¾	25·9	
Rape Cake	560	2·0	12·4	8·2	6	1,164	1,242	78	9·43	582¼	20·8	151¼
Bean-meal	560	2·0	12·4	8·2	7	1,260	1,284	24		600½	21·4	
Clover-chaff	3,920	14·0	87·0	57·5	8	944	954	10		637¼	22·8	
Straw-chaff	2,156	7·7	47·8	31·6	9	1,156	1,198	42		557¼	19·9	
Pulped Swedes	14,112	50·4	313·1	207·0	10	1,236	1,312	76		970¾	34·7	
					Totals	11,057	11,482	425	—	6,817¼	—	—
					Averages	1,106	1,148	42	9·43	681¾	24·4	151½
Lot 2.—10 Cows; Special Food—Malted Barley "No. 1." (with Malt-dust).												
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,184	1,216	32		438¼	15·7	
					2	992	1,024	32		771	27·5	
					3	1,260	1,336	76		376¼	13·4	
					4	1,020	1,047	27		601¾	21·5	
Barley, malted (with its dust)	829*	3·0*	18·4*	12·4*	5	914	942	28		656¾	23·5	
Rape Cake	560	2·0	12·4	8·4	6	1,316	1,400	84	11·17	659½	23·6	148¼
Bean-meal	560	2·0	12·4	8·4	7	1,008	1,076	68		744¼	26·6	
Clover-chaff	3,920	14·0	87·1	58·7	8	1,065	1,132	67		654½	23·4	
Straw-chaff	2,156	7·7	47·9	32·3	9	1,040	1,098	58		783¼	28·0	
Pulped Swedes	14,112	50·4	313·4	211·2	10	1,206	1,237	31		997¾	35·6	
					Totals	11,005	11,508	503	—	6,683¼	—	—
					Averages	1,101	1,151	50	11·17	668¼	23·9	148½

* These figures represent not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.

Table XXII.—Experiments made with COWS, at Newlands Farm, Rugby.

Record of the Food consumed, of the Weights, of the Increase in Live-weight, and of the Milk yielded.

2nd Period, 4 Weeks January 18 to February 15, 1864.

Food consumed.					Cows.	Weights. Increase (or Loss) in Live-weight and Milk.						
						Weights.		Increase (or Loss) in Live-weight.		Milk yielded.		
—	Total in 4 Weeks.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.	To produce 100 lbs. Milk.		Jan. 18.	Feb. 15.	Total in 4 Weeks.	Per 1000 lbs. Live-weight per Week.	Total in 4 Weeks.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.
Lot 1.—10 Cows; Special Food—Unmalted Barley "No. 1."												
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,134	1,116	-18		507¾	18·1	
					2	1,112	1,095	—17		860½	31·1	
					3	1,127	1,132	5		711¾	25·4	
					4	1,125	1,144	19		614½	22·0	
Barley, unmalted	840	3·0	18·2	12·8	5	994	1,016	22		681¾	24·3	
Rape Cake	560	2·0	12·1	8·5	6	1,242	1,280	38	2·38	563¾	20·1	142¼
Bean-meal	560	2·0	12·1	8·5	7	1,284	1,300	16		574¾	20·5	
Clover-chaff	3,920	14·0	84·9	59·6	8	954	964	10		644¾	23·0	
Straw-chaff	2,156	7·7	46·7	32·8	9	1,198	1,239	41		508	18·1	
Pulped Swedes	14,112	50·4	305·6	214·5	10	1,312	1,306	—6		901¼	32·2	
					Totals	11,482	11,592		—	6,577¼	—	—
					Averages	1,148	1, 59		·38	657¾	23·5	142¼
Lot 2.—10 Cows; Special Food—Malted Barley "No. ." (with Malt-dust).												
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,216	1,288	72		436¼	15·6	
					2	1,024	1,024	—		754	26·9	
					3	1,336	1,392	56		80	2·9	
					4	1,047	1,047	—		576½	20·6	
Barley, malted (with its dust)	829*	3·0*	17·9*	13·7*	5	912	934	—8		5[illegible]	21·1	
Rape Cake	560	2·0	12·1	9·3	6	1,400	1,392	—8	1·93	63[illegible]	22·8	130½
Bean-meal	560	2·0	12·1	9·3	7	1,076	1,076	—		731	26·1	
Clover-chaff	3,920	14·0	84·8	65·0	8	1,132	1,144	12		843¾	30·8	
Straw-chaff	2,156	7·7	46·7	35·7	9	1,098	1,106	8		815¾	29·1	
Pulped Swedes	14,112	50·4	305·4	233·6	10	1,237	1,194	43		829¾	29·6	
					Totals	[illegible]	[illegible]	[illegible]	—	[illegible]		

3rd Period, 2 Weeks; February 15 to February 29, 1864.

Food consumed.	Total in 2 Weeks.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.	To produce 100 lbs. Milk.	Cows.	Weights. Feb. 15.	Weights. Feb. 29.	Increase (or Loss) in Live-weight. Total in 2 Weeks.	Increase (or Loss) in Live-weight. Per 1000 lbs. Live-weight per Week.	Milk yielded. Total in 2 Weeks.	Milk yielded. Per Head per Day.	Milk yielded. Per 1000 lbs. Live-weight per Week.
Lot 1.—10 Cows; Special Food—Unmalted Barley "No. 1."												
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,116	1,136	20		268¾	19·2	
					2	1,095	1,114	19		430	30·7	
					3	1,132	1,150	18		351¼	25·1	
					4	1,144	1,150	6		301¼	21·5	
Barley, unmalted	420	3·0	18·0	11·6	5	1,016	1,018	2		349¾	25·0	
Rape Cake	280	2·0	12·0	8·6	6	1,280	1,312	32	7·24	279½	20·0	140
Bean-meal	280	2·0	12·0	8·6	7	1,300	1,308	8		274¾	19·6	
Clover-chaff	1,960	14·0	83·9	59·9	8	964	974	10		344¼	24 6	
Straw-chaff	1,078	7·7	46·2	32·9	9	1,239	1,252	13		237	16·9	
Pulped Swedes	7,056	50·4	302·1	215·6	10	1,306	1,347	41		435¼	31·1	
					Totals	11,592	11,760	169	—	3,272	—	—
					Averages	1,159	1,176	17	7·24	327¼	23·4	140
Lot 2.—10 Cows; Special Food—Malted Barley "No. 1." (with Malt-dust).												
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,288	1,310	22		191¼	13·7	
					2	1,024	1,022	—2		376½	26·9	
					3	1,392	1,428	36		3¼	0·2	
					4	1,047	1,066	19		282	20·1	
Barley, malted (with its dust)	414*	3·0*	17·8*	14·4*	5	934	936	2	5·23	273¾	19·6	123½
Rape Cake	280	2·0	12·0	9·7	6	1,392	1,396	4		320	22·9	
Bean-meal	280	2·0	12·0	9·7	7	1,076	1,076	—		365¾	26·1	
Clover-chaff	1,960	14·0	84·1	68·0	8	1,144	1,179	35		274¼	19·6	
Straw-chaff	1,078	7·7	46·2	37·4	9	1,106	1,092	—14		397	28·4	
Pulped Swedes	7,056	50·4	302·6	244·8	10	1,194	1,214	20		398¼	28·4	
					Totals	11,597	11,719	122	—	2,882	—	—
					Averages	1,160	1,172	12	5·23	288¼	20·6	123½

* These figures represent not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.

[redacted]

TABLE XXIV.—EXPERIMENTS made with COWS, at NEWLANDS FARM, 1

SUMMARY of the WEIGHTS, INCREASE in LIVE-WEIGHT, and YIELD of MIL

Cows.	Weights at Commencement (Dec. 21, 1863).	Increase (or Loss) in Weight. In 4 weeks; Dec. 21, 1863, to Jan. 18, 1864.	In 4 weeks; Jan. 18, to Feb. 15.	In 2 weeks; Feb. 15, to Feb. 29.	Weights at Conclusion (Feb. 29, 1864).	Summary of the Increase (or Loss) in Weight. Total in 10 weeks.	Per Head per week.	Per 1000 lbs. Live-weight per week.	Yield of Mil First week.	Last week.
Lot 1.—10 Cows; Special Food—Unmalted Barley "No. 1."										
Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	1,086	48	—18	20	1,136	50	5 0	4 8	158 12	132 5
2	1,044	68	—17	19	1,114	70	7 0	6 7¾	229 2	217 3
3	1,065	62	5	18	1,150	85	8 8	7 10¾	180 7	175 14
4	1,082	43	19	6	1,150	68	6 12¾	6 1½	165 14	149 1
5	1,020	—26	22	2	1,018	— 2	—0 3¼	0 3¼	187 4	174 2
6	1,164	78	38	32	1,312	148	14 12¾	11 15¼	157 6	139 11
7	1,260	24	16	8	1,308	48	4 12¾	3 11¾	156 4	136 7
8	944	10	10	10	974	30	3 0	3 2	177 13	178 8
9	1,156	42	41	13	1,252	96	9 9½	7 15¼	150 12	117 6
10	1,236	76	— 6	41	1,347	111	11 1½	8 9¼	265 12	217 11
Totals .	11,057	425	110	169	11,761	704	——	——	1,829 6	1,630 4
Averages	1,106	42	11	17	1,176	70	7 0¾	6 2¾	182 15	163 0
Lot 2.—10 Cows; Special Food—Malted Barley "No. 1." (with Malt-dust).										
Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1	1,184	32	72	22	1,310	126	12 9½	10 1¾	125 2	89 14
2	992	32	——	— 2	1,022	30	3 0	2 15¾	202 8	186 1
3	1,260	76	56	36	1,428	168	16 12¾	12 8	137 4	——
4	1,020	27	——	19	1,066	46	4 9½	4 6½	157 15	135 9
5	914	28	— 8	2	936	22	2 3¼	2 6	173 13	132 5
6	1,316	84	— 8	2	1,396	80	8 0	5 14¼	169 7	154 10
7	1,008	68	——	——	1,076	68	6 12¾	6 8¼	187 1	183 14
8	1,065	67	12	35	1,179	114	11 6½	10 2¼	180 5	134 13
9	1,040	58	8	—14	1,092	52	5 3¼	4 14	202 14	190 6
10	1,206	31	—43	20	1,214	8	0 12¾	0 10¼	260 15	195 0
Totals .	11,005	503	89	122	11,719	714	——	——	1,797 4	1,402 8
Averages	1,101	50	9	12	1,172	71	7 2¼	6 4¼	179 12	840

ABLE XXV.—EXPERIMENTS made with OXEN, at ROTHAMSTED, HERTS.

led Record of the Food consumed, of the Weights, and of the Increase of Live-weight.
1st Period of 4 Weeks; December 1 to December 29, 1863.

Lot 1.—10 Oxen; Special Food.—Unmalted Barley "No. 2."

—	Food consumed. Total in Four Weeks.	Food consumed. Per Head per Day.	Food consumed. Per 1000 lbs. Live-weight per Week.	Food consumed. To produce 100 lbs. Increase.	Oxen.	Weights. Dec. 1.	Weights. Dec. 29.	Increase (or Loss) in Live-weight. Total in Four Weeks.	Increase (or Loss) in Live-weight. Per Head per Week.	Increase (or Loss) in Live-weight. Per 1000 lbs. Live-weight per Week.
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,151	1,156	5	1·3	
					2	1,079	1,170	91	22·8	
					3	1,183	1,275	92	23·0	
					4	1,097	1,163	66	16·5	
	lbs.	lbs.	lbs.	lbs.	5	1,095	1,166	71	17·7	
lted	1,120	4·0	24·8	156·0	6	1,039	1,107	68	17·0	16
. .	2,240	8·0	49·6	312·0	7	1,152	1,215	63	15·8	
ι .	24,867	88·8	551·1	3463·4	8	1,015	1,131	116	29·0	
					9	1,102	1,174	72	18·0	
					10	1,008	1,082	74	18·5	
					Totals . .	10,921	11,639	718	—	—
					Averages .	1,092	1,164	71⅘	18·0	16

Lot 2.—10 Oxen; Special Food.—Malted Barley "No. 2," (with Malt-dust).

—	Food consumed. Total in Four Weeks.	Food consumed. Per Head per Day.	Food consumed. Per 1000 lbs. Live-weight per Week.	Food consumed. To produce 100 lbs. Increase.	Oxen.	Weights. Dec. 1.	Weights. Dec. 29.	Increase (or Loss) in Live-weight. Total in Four Weeks.	Increase (or Loss) in Live-weight. Per Head per Week.	Increase (or Loss) in Live-weight. Per 1000 lbs. Live-weight per Week.
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,204	1,226	22	5·5	
					2	1,057	1,148	91	22·8	
					3	1,148	1,208	60	15·0	
					4	1,088	1,142	54	13·5	
	lbs.	lbs.	lbs.	lbs.	5	1,176	1,184	8	2·0	
t }	1,120*	4·0*	25·0*	221·3*	6	1,092	1,079	—13	- 3·2	11¼
.	2,240	8·0	50·0	442·7	7	1,078	1,090	12	3·0	
. .	23,749	84·8	529·6	4693.5	8	1,029	1,065	36	9·0	
					9	1,078	1,661	88	22·0	
					10	1,008	1,156	148	37·0	
					Totals . .	10,958	11,464	506	—	—
					Averages .	1,096	1,146	50⅗	12·7	11¼

*figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which l be produced.

TABLE XXVI.—EXPERIMENTS made with OXEN, at ROTHAMSTED, HERTS.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight.
2nd Period of 4 Weeks: December 29, 1863, to January 26, 1864.

Food consumed.					Oxen.	Weights, and Increase in Live-weight.				
						Weights.		Increase in Live-weight.		
—	Total in Four Weeks.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.	Oxen.	Dec. 29, 1863.	Jan. 26, 1864.	Total in Four Weeks.	Per Head per Week.	Per 1000 lbs. Live-weight per Week.
Lot 1.—10 Oxen; Special Food—Unmalted Barley "No. 2."										
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,156	1,228	72	18·0	
					2	1,170	1,222	52	13·0	
					3	1,275	1,368	93	23·3	
					4	1,163	1,219	56	14·0	
	lbs.	lbs.	lbs.	lbs.	5	1,166	1,222	56	14·0	15
Barley, unmalted	1,120	4·0	23·3	147·0	6	1,107	1,185	78	19·5	
Clover-chaff . .	2,800	10·0	58·2	367·5	7	1,215	1,323	108	27·0	
Swedes, *ad lib.* .	25,511	91·1	530·6	3347·9	8	1,131	1,208	77	19·2	
					9	1,174	1,268	94	23·5	
					10	1,082	1,158	76	19·0	
					Totals . .	11,639	12,401	762	—	—
					Averages .	1,164	1,240	76¼	19·0	15
Lot 2.—10 Oxen; Special Food—Malted Barley "No. 2" (with Malt-dust).										
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,226	1,323	97	24·3	
					2	1,148	1,208	70	17·5	
					3	1,208	1,316	108	27·0	
					4	1,142	1,232	90	22·5	
	lbs.	lbs.	lbs.	lbs.	5	1,184	1,262	78	19·5	16
Barley, malted, with its dust	1,120*	4·0*	23·6*	142·5*	6	1,079	1,132	53	13·2	
Clover-chaff . .	2,800	10·0	59·0	356·2	7	1,090	1,164	74	18·5	
Swedes, *ad lib.* .	26,057	93·1	549·4	3315·1	8	1,065	1,162	97	24·3	
					9	1,166	1,225	59	14·7	
					10	1,156	1,216	60	15·0	
					Totals . .	11,464	12,250	786	—	—
					Averages .	1,146	1,225	78½	19·6	16

* *These figures* represent, not the actual weights of malt and malt-dust, but the weight of the barley from whi[ch they wou]ld be produced.

'ABLE XXVII.—EXPERIMENTS made with OXEN, at ROTHAMSTED, HERTS.

iled Record of the Food consumed, of the Weights, and of the Increase in Live-weight.
3rd Period of 4 Weeks; January 26 to February 23, 1864.

Food consumed.					Oxen.	Weights, and Increase in Live-weight.				
						Weights.		Increase in Live-weight.		
—	Total in Four Weeks.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		Jan. 26.	Feb. 23.	Total in Four Weeks.	Per Head per Week.	Per 1000 lbs. Live-weight per Week.
Lot 1.—10 Oxen; Special Food—Unmalted Barley "No. 2."										
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,228	1,299	71	17·8	
					2	1,222	1,274	52	13·0	
					3	1,368	1,465	97	24·2	
	lbs.	lbs.	lbs.	lbs.	4	1,219	1,302	83	20·8	
y, unmalted	1,120	4·0	21·9	156·3	5	1,222	1,291	69	17·2	14¼
. . .	560	2·0	11·0	77·1	6	1,185	1,260	75	18·8	
chaff. .	3,360	12·0	65·8	462·8	7	1,323	1,393	70	17·5	
ad lib. .	21,757	77·7	426·1	2996·8	8	1,208	1,288	80	20·0	
					9	1,268	1,351	83	20·7	
					10	1,158	1,204	46	11·5	
					Totals . .	12,401	13,127	726	—	—
					Averages .	1,240	1,313	72¾	18·2	14¼
Lot 2.—10 Oxen; Special Food—Malted Barley "No. 2" (with Malt-dust).										
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,323	1,400	77	19·3	
					2	1,218	1,295	77	19·3	
					3	1,316	1,383	67	16·7	
	lbs.	lbs.	lbs.	lbs.	4	1,232	1,274	42	10·5	
malted, dust	1,120*	4·0*	22·3*	177·5*	5	1,262	1,325	63	15·8	12¼
. . .	560	2·0	11·1	88·7	6	1,132	1,185	53	13·2	
ff. .	3,360	12·0	66·9	532·5	7	1,164	1,253	89	22·3	
lib. .	20,930	74·8	416·4	3317·0	8	1,162	1,197	35	8·7	
					9	1,225	1,288	63	15·8	
					10	1,216	1,281	65	16·2	
					Totals . .	12,250	12,881	631	—	—
					Averages .	1,225	1,288	63	15·8	12¼

figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which d be produced.

TABLE XXVIII.—EXPERIMENTS made with OXEN, at ROTHAMSTED, HERTS.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight.

4th Period of 4 Weeks: **February 23 to March 22, 1864.**

Food consumed.					Oxen.	Weights.		Increase (or Loss) in Live-weight.		
	Total in Four Weeks.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		Feb. 23.	Mar. 22.	Total in Four Weeks.	Per Head per Week.	Per 1000 lbs. Live-weight per Week.
Lot 1.—10 Oxen; Special Food—Unmalted Barley "No. 2."										
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,299	1,316	17	4·3	
					2	1,274	1,328	54	13·5	
					3	1,465	1,470	5	1·2	
	lbs.	lbs.	lbs.	lbs.	4	1,[illegible]	1,314	12	3·0	
Barley, unmalted	1,120	4·0	21·3	1287·4	5	1,291	1,310	19	4·8	
Oilcake	560	2·0	10·6	643·7	6	1,260	1,238	—22	—5·5	
Clover-chaff	3,360	12·0	63·8	3862·1	7	1,393	1,392	—1	—0·2	
Swedes, *ad lib.*	18,175	64·9	345·0	20890·8	8	1,288	1,294	6	1·5	
					9	1,361	1,363	2	0·5	
					10	1,204	1,198	—6	—1·5	
					Totals	13,127	13,214	87	—	—
					Averages	1,313	1,321	8 7/10	2·2	
Lot 2.—10 Oxen; Special Food—Malted Barley "No. 2" (with Malt-dust).										
					Nos.	lbs.	lbs.	lbs.	lbs.	
					1	1,400	1,437	37	9·3	
					2	1,295	1,300	5	1·2	
					3	1,383	1,430	47	11·8	
	lbs.	lbs.	lbs.	lbs.	4	1,274	1,311	37	9·2	
Barley, malted, with its dust	1,120*	4·0*	21·5*	388·9*	5	1,325	1,334	9	2·3	
Oilcake	560	2·0	10·7	194·4	6	1,185	1,210	25	6·2	
Clover-chaff	3,360	12·0	64·5	1166·7	7	1,253	1,276	23	5·8	
Swedes, *ad lib.*	19,332	69·0	371·1	6712·5	8	1,197	1,252	55	13·7	
					9	1,288	1,311	23	5·8	
					10	1,281	1,308	27	6·7	
					Totals	12,881	13,169	288	—	—
					Averages	1,288	1,317	28 4/5	7·2	

* *These figures represent, not the actual weights of malt and malt-dust, but the weights of the barley from which they would be produced.*

BLE XXIX.—EXPERIMENTS made with OXEN, at ROTHAMPSTED, HERTS.

led Record of the Food consumed, of the Weights, and of the Increase in Live-weight.
5th Period of 4 Weeks; March 22 to April 19, 1864.

Food consumed.					Oxen.	Weights, and Increase in Live-weight.				
						Weights.		Increase in Live-weight.		
—	Total in Four Weeks.	Per Head per Day.	Per 1000 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		Mar. 22.	Apr. 19.	Total in Four Weeks.	Per Head per Week.	Per 1000 lbs. Live-weight per Week.
Lot 1.—10 Oxen; Special Food—Unmalted Barley "No. 2."										
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,316	1,404	88	22·0	
					2	1,328	1,386	58	14·5	
					3	1,470	1,591	121	30·3	
	lbs.	lbs.	lbs.	lbs.	4	1,314	1,404	90	22·5	
unmalted	1,120	4·0	20·3	101·8	5	1,310	1,422	112	28·0	20
. . .	1,120	4·0	20·3	101·8	6	1,238	1,344	106	26·5	
haff . .	3,360	12·0	61·0	305·5	7	1,392	1,566	174	43·5	
Swedes .	3,856	13·8	70·0	350·5	8	1,294	1,424	130	32·5	
Mangolds	13,980	49·0	253·9	1,270·9	9	1,353	1,482	129	32·2	
					10	1,199	1,291	92	23·0	
					Totals .	13,214	14,314	1,100	—	—
					Averages .	1,321	1,431	110	27·5	20
Lot 2.—10 Oxen; Special Food—Malted Barley "No. 2" (with Malt-dust).										
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	1,437	1,525	88	22·0	
					2	1,300	1,422	122	30·5	
					3	1,430	1,525	95	23·8	
	lbs.	lbs.	lbs.	lbs.	4	1,311	1,396	85	21·2	
alted, s dust	1,120*	4·0*	20·7*	144·7*	5	1,334	1,444	110	27·5	14½
. . .	1,120	4·0	20·7	144·7	6	1,210	1,256	46	11·5	
ff . .	3,360	12·0	62·0	434·1	7	1,276	1,346	70	17·5	
redes .	4,347	15·5	80·2	561·6	8	1,252	1,252	—	—	
angolds	14,490	51·8	267·2	1,872·1	9	1,311	1,385	74	18·5	
					10	1,308	1,392	84	21·0	
					Totals. .	13,169	13,943	774	—	—
					Averages .	1,317	1,394	77½	19.4	14½

figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which l be produced.

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Table XXX.—Experiments made with OXEN, at Rothampsted, Hert

Summary of the Weights, and of the Increase in Live-weight. Total Period 20 Wee
December 1, 1863, to April 19, 1864.

Oxen.	Weights at Commencement, Dec. 1, 1863.	Increase (or Loss) in Weight. In Four Weeks; Dec. 1 to Dec. 29, 1863.	In Four Weeks; Dec. 29, 1863, to Jan 26, 1864.	In Four Weeks; Jan. 26 to Feb. 23, 1864.	In Four Weeks; Feb. 23 to Mar. 22, 1864.	In Four Weeks; Mar. 22 to Apr. 19, 1864.	Weights at Conclusion, April 19, 1863.	Summary of the Incre in Weight. Total in Twenty Weeks.	Per Head per Week.		Pe 1000 Liv wei pe We
Lot 1.—10 Oxen; Special Food—Unmalted Barley "No. 2."											
Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	ozs	lbs.
1	1,151	5	72	71	17	88	1,404	253	12	10	9
2	1,079	91	52	52	54	58	1,386	307	15	6	12
3	1,183	92	93	97	5	121	1,591	408	20	6	14
4	1,097	66	56	83	12	90	1,404	307	15	6	12
5	1,095	71	56	69	19	112	1,422	327	16	6	13
6	1,039	68	78	75	—22	106	1,344	305	15	4	12
7	1,152	63	108	70	— 1	174	1,566	414	20	11	15
8	1,015	116	77	80	6	130	1,424	409	20	7	16
9	1,102	72	94	83	2	129	1,482	380	19	0	14
10	1,008	74	76	46	— 5	92	1,291	283	14	2	12
Totals .	10,921	718	762	726	87	1,100	14,314	3,393	——		—
Averages .	1,092	71⅘	76⅕	72⅗	8⅞	110	1,431⅖	339⅓	16	15	13
Lot 2.—10 Oxen; Special Food—Malted Barley "No. 2" (with Malt-dust).											
Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	ozs.	lbs.
1	1,204	22	97	77	37	88	1,525	321	16	1	11
2	1,067	91	70	77	5	122	1,422	365	18	4	14
3	1,148	60	108	67	47	95	1,525	377	18	14	14
4	1,088	54	90	42	37	85	1,396	308	15	6	12
5	1,176	8	78	63	9	110	1,444	268	13	6	10
6	1,092	—13	53	53	25	46	1,256	164	8	3	7
7	1,078	12	74	89	23	70	1,346	268	13	6	11
8	1,029	36	97	35	55	——	1,252	223	11	2	9
9	1,078	88	59	63	23	74	1,385	307	15	6	12
10	1,008	148	60	65	27	84	1,392	384	19	3	16
Totals .	10,958	506	786	631	288	774	13,943	2,985	——		—
Averages .	1,095⅘	50⅗	78⅗	63	28⅘	77⅖	1,394⅓	298½	14	15	12

Periods. Dates.	Number of Weeks.	Food consumed. Per Head per Week. Barley (or Malt).	Oilcake.	Clover-chaff.	Roots.	Per 1000 lbs. Live-weight per Week. Barley (or Malt).	Oilcake.	Clover-chaff.	Roots.	To produce 100 lbs. increase. Barley (or Malt.)	Oilcake.	Clover-chaff.	Roots.	Increase in Weight. Per Head per Week.	Per 1000 lbs. Live-weight per Week.
Lot 1.—10 Oxen; Special Food—Unmalted Barley "No. 2."															
1863-4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
Dec. 1 to Dec. 29	4	28·0	—	56·0	621¼	24·8	—	49·6	551·1	156·0	—	312·0	3,464·4	17 15¾	15 14¼
Dec. 29 to Jan. 26	4	28·0	—	70·0	637¾	23·3	—	58·2	530·6	147·0	—	367·5	3,347·9	19 0¼	15 13¼
Jan. 26 to Feb. 23	4	28·0	14·0	84·0	544	21·9	11·0	65·8	426·1	154·3	77·1	462·8	2,996·8	18 2¼	14 2¼
Feb. 23 to March 22	4	28·0	14·0	84·0	454½	21·3	10·6	63·8	345·0	1287·4	643·7	3862·1	20,890·8	2 2¼	1 10½
March 22 to April 19	4	28·0	28·0	84·0	446	20·3	20·3	61·0	324·6	101·8	101·8	305·5	1,621·5	27 8	19 14¾
Dec. 1 to April 19	20	28·0	11·2	75·6	540¼	22·2	8·9	59·9	428·6	165·1	66·0	445·6	3,187·3	16 15¼	13 7¼
Lot. 2.—10 Oxen; Special Food—Malted Barley "No. 2" (with Malt-dust).															
1863-4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
Dec. 1 to Dec. 29	4	*28·0	—	56·0	593¾	*25·0	—	50·0	529·6	*221·3	—	442·7	4,693·5	12 10¼	11 4¼
Dec. 29 to Jan. 26	4	*28·0	—	70·0	651¼	*23·6	—	59·0	549·4	*142·5	—	356·2	3,315·1	19 10½	16 8
Jan. 26 to Feb. 23	4	*28·0	14·0	84·0	523¼	*22·3	11·1	66·9	416·4	*177·5	88·7	532·5	3,317·0	15 12½	12 8¾
Feb. 23 to March 22	4	*28·0	14·0	84·0	487¼	*21·5	10·7	64·5	371·1	*388·9	194·4	1166·7	6,712·5	7 3¼	5 8¼
March 22 to April 19	4	*28·0	28·0	84·0	471	*20·7	20·7	62·0	347·4	*144·7	144·7	434·1	2,433·7	19 5¼	14 4½
Dec. 1 to April 19	20	*28·0	11·2	75·6	544½	*22·5	9·0	60·7	437·4	*187·6	75·0	506·5	3,648·4	14 14¾	11 15¾

* These figures represent not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.

TABLE XXXII.—EXPERIMENTS made with OXEN, at ROTHAMPSTED, HERTS.

Weights of the Carcasses, and of some other separated Parts.

Designation of Parts.	Oxen. No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	Means.
Lot 1.—Special food.—Unmalted Barley "No. 2."											
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Caul fat	23	27	28	24	35	24	32	20	23	23	26
Intestinal fat	65	65	61	51	72	52	71	65	68	47	61¾
Heart	5	5	6	6	6	5¾	5½	6¾	6¾	5¾	6
Liver	15	15½	15	17	15¼	15	19¾	19	16	13	16
Head and Tongue	33	34	43	38	34	37	34	33	35	35	35⅝
Hide	85	80	96	84	74	83	78	66	82	77	80½
Total	226	226½	249	220	236¼	216¾	240¼	209¾	230¾	200¾	225⅝
Other offal parts, loss by fasting, evaporation, &c.	426	355½	424	374	381¾	379¼	467¾	410¼	387¼	346¼	395
Carcass (cold)	752	804	918	810	804	748	858	804	864	744	810⅝
Live-weight (unfasted)	1404	1386	1591	1404	1422	1344	1566	1424	1482	1291	1431
Lot. 2.—Special Food.—Malted Barley "No. 2" (with Malt-dust).											
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Caul fat	28	22	27	18	28	21	20	19	20	23	22½
Intestinal fat	84	38	77	54	63	56	67	59	70	72	64
Heart	6	6⅝	7¾	6	6	6	5½	5½	6½	5¼	6
Liver	17	14	15¾	17¾	16	13	15	13¼	15	17	15½
Head and Tongue	39½	35	39½	38¾	37½	37⅝	35½	36½	38¼	36½	37½
Hide	87	94	89	82	74	79	92	78	91	84	85
Total	261½	209⅝	256	216½	224½	212⅝	235	211¼	240¾	237¾	230½

	Oxen.										
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	Means.
Lot 1.—Special Food.—Unmalted Barley "No. 2."											
Caul fat	1·64	1·95	1·76	1·71	2·46	1·79	2·04	1·40	1·55	1·78	1·81
Intestinal fat	4·63	4·69	3·84	3·63	5·07	3·87	4·54	4·57	4·59	3·64	4·31
Heart	0·36	0·36	0·38	0·43	0·42	0·43	0·37	0·47	0·46	0·45	0·41
Liver	1·07	1·12	0·94	1·21	1·09	1·12	1·26	1·33	1·08	1.01	1·12
Head and Tongue	2·35	2·45	2·70	2·71	2·39	2·75	2·17	2.32	2·36	2·71	2·49
Hide	6·05	5·77	6·03	5·98	5·20	6·17	4·98	4·64	5·53	5·96	5·63
Total	16·10	16·34	15·65	15·67	16·63	16·13	15·36	14·73	15·57	15·55	15·77
Other offal parts, loss by fasting, evaporation, &c.	30·34	25·65	26·65	26·64	26·83	28·22	29·85	28·81	26·13	26·82	27·60
Carcass (cold)	53·56	58·01	57·70	57·69	56·64	55·65	54·79	56·46	58·30	57·63	56·63
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Lot 2.—Special food.—Malted Barley "No. 2" (with Malt-dust).											
Caul fat	1·84	1·55	1·77	1·29	1·94	1·67	4·48	1·52	1·45	1·65	1·62
Intestinal fat	5·51	2·67	5·05	3·87	4·36	4·46	4·98	4·71	5·05	5·17	4·58
Heart	0·39	0.48	0·51	0·43	0·42	0·48	0·43	0·42	0·45	0·40	0·44
Liver	1·11	0·98	1·03	1·27	1·11	1·04	1·11	1·07	1·08	1·22	1·10
Head and Tongue	2·59	2·46	2·59	2·76	2·59	3·00	2·62	2·92	2·76	2·61	2·69
Hide	5·71	6·61	5·84	5·87	5·13	6·29	6·84	6·23	6·57	6·03	6·11
Total	17·15	14·75	16·79	15·49	15·55	16·94	17·46	16·87	17·36	17·08	16·54
Other offal parts, loss by fasting, evaporation, &c.	27·77	28·85	30·23	28·49	27·39	27·81	29·49	25·46	26·61	26·31	27·84
Carcass (cold)	55·08	56·40	52·98	56·02	57·06	55·25	53·05	57·67	56·03	56·61	55·62
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

TABLE XXXIV.—EXPERIMENTS made with SHEEP, at ROTHAMPSTED, HERTS.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight.

1st Period of 4 Weeks; December 2 to December 30, 1863.

—	Food consumed. Total in 4 Weeks.	Food consumed. Per Head per Day.	Food consumed. Per 100 lbs. Live-weight per Week.	Food consumed. To produce 100 lbs. Increase.	Sheep.	Weights. Dec. 2, 1863.	Weights. Dec. 30, 1863.	Increase in Live-weight. Total in 4 Weeks.	Increase in Live-weight. Per Head per Week.	Increase in Live-weight. Per 100 lbs. Live-weight per Week.
Lot 1.—12 Sheep; Special Food—Unmalted Barley "No. 1."										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	252	0·75	4·96	183·9	1	112	121	9	2·25	
Clover-chaff	336	1·00	6·59	245·3	2	101	115	14	3·50	
Swedes, ad lib.	3,360	10·00	[illegible]	2,[illegible]·0	3	101	114	13	3·25	
					4	107	114	7	1·75	
					5	100	108	8	2·00	
					6	92	104	12	3·00	2·69
					7	100	110	10	2·50	
					8	105	119	14	3·50	
					9	89	103	14	3·50	
					10	119	131	12	3·00	
					11	88	100	12	3·00	
					12	94	106	12	3·00	
					Totals	1,207	1,344	137	—	—
					Averages	101	112	11½	2·85	2·69
Lot 2.—12 Sheep; Special Food—Malted Barley "No. 1" (with Malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	109	120	11	2·75	
					2	94	104	10	2·50	
					3	96	105	9	2·25	
					4	100	108	8	2·00	
					5	119	133	14	3·50	
					6	112	126	14	3·50	
Barley, malted, with its dust	[illegible]*	0·74*	4·87*	[illegible]*	7	94	104	10	2·50	2·64
					8	102	114	12	3·00	

	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	250	0·75	4·96	198·4
Clover-chaff	336	1·00	6·63	264·6
Swedes, ad lib.	3,660	10·90	78·47	2,897·6

3	114	[illegible]	9	3·00	2·50
4	108	114	11	2·75	
5	108	116	11	2·75	
6	94	108	12	3·00	
7	98	109	10	2·80	
8	84	91	7	1·75	
9	104	112	8	3·00	
10	104	114	10	2·50	
11	89	100	13	2·75	
12	86	93	7	1·75	
Totals . .	1,206	1,333	127	—	—
Averages .	100	111	10½	2·65	2·50

Lot 4.—12 Sheep; Special Food—Malted Barley "No. 2" (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Barley, malted, with its dust . . .	259*	0·75*	4·93*	195·8*
Clover-chaff	336	1·00	6·57	206·5
Swedes, ad lib.	3,665	10·99	71·75	2,621·5

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	119	126	7	1·75	2·84
2	114	126	12	3·00	
3	94	105	11	2·75	
4	108	114	12	3·00	
5	108	120	12	3·00	
6	91	103	12	3·00	
7	107	119	12	3·00	
8	91	102	11	2·75	
9	102	114	12	3·00	
10	94	104	10	2·50	
11	100	110	10	2·50	
12	91	100	9	2·25	
Totals . .	1,213	1,343	130	—	—
Averages .	101	112	10¾	2·71	2·[illegible]

Lot 5.—12 Sheep; Special Food—Unmalted and Malted Barley No. 2 (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	168	0·50	3·33	117·5
Barley, malted, with its dust . .	84*	0·25*	1·66*	58·7*
Clover-chaff	336	1·00	6·65	235·0
Swedes, ad lib.	3,669	10·92	72·65	2,565·0

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	99	144	16	4·00	2·63
2	114	126	12	3·00	
3	91	101	10	2·50	
4	104	114	10	2·50	
5	94	108	14	3·50	
6	96	112	16	4·00	
7	94	105	11	2·75	
8	102	114	12	3·00	
9	91	103	12	3·00	
10	95	108	10	2·50	
11	88	98	10	2·60	
12	91	101	10	2·50	
Totals . .	1,191	1,334	143	—	—
Averages .	99	111	12	2·99	2·63

* These figures represent not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.

Table XXXV.—Experiments made with SHEEP, at Rothamsted, Herts.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight.

2nd Period of Four Weeks December 30, 1863, to January 27, 1864.

—	Food consumed. Total in 4 Weeks.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.	Sheep.	Weights, and Increase (or Loss) in Live-weight. Weights. Dec. 30, 1863.	Jan. 27, 1864.	Increase (or Loss) in Live-weight. Total in 4 Weeks.	Per Head per Week.	Per 100 lbs. Live-weight per Week.
Lot 1.—12 Sheep; Special Food—Unmalted Barley "No. 1."										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	121	126	5	1·25	
					2	113	122	9	2·25	
					3	114	122	8	2·00	
					4	114	120	6	1·50	
					5	109	119	10	2·50	
					6	104	110	6	1·50	
Barley, unmalted	252	0·75	4·53	268·1	7	110	118	8	2·00	1·69
Clover-chaff	336	1·00	6·04	357·4	8	119	129	10	2·50	
Swedes, ad lib.	3,664	10·90	65·85	3,897·9	9	102	112	10	2·50	
					10	131	140	9	2·25	
					11	100	105	5	1·25	
					12	106	114	8	2·00	
					Totals	1,344	1,438	94	—	—
					Averages	112	[illegible]	7⅚	1·96	1·69
Lot 2.—12 Sheep; Special Food—Malted Barley "No. 1 (with Malt-dust)"										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	130	136	6	1·50	
					2	104	110	6	1·50	
					3	105	114	9	2·25	
					4	108	120	12	3·00	
					5	133	145	12	3·00	
					6	135	145	10	2·50	
Barley, malted, with its dust	249*	0·74*	4·46*	251·1*	7	104	108	4	1·00	1·77
Clover-chaff	336	1·00	6·02	339·4	8	114	120	6	1·50	
Swedes, ad lib.	3,[illegible]	12·9[illegible]	66·0[illegible]	3,7[illegible]	9	115	125	10	2·50	
					10	101	113	12	3·00	
					11	110	114	4	1·00	
					12	102	110	8	2·00	
					Totals	[illegible]	1,444	99	—	—
					[illegible]				2·06	1·77

	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	309	0·73	4·33	283·0
Clover-chaff	336	1·00	6·05	297·3
Swedes, ad lib.	3,687	10·97	46·24	3,263·9

2	[illegible]	[illegible]	[illegible]	2·00	2·[illegible]
3	12[illegible]	134	12	2·00	
4	116	134	9	2·50	
5	116	120	14	2·75	
6	100	117	11	1·00	
7	108	112	4	1·75	
8	91	98	7	2·50	
9	118	128	10	2·00	
10	114	122	8	2·00	
11	108	116	12	3·00	
12	93	100	7	1·75	
Totals . .	1,333	1,446	113	—	—
Averages .	111	120	9⅓	2·36	2·08

Lot 4.—12 Sheep; Special Food—Malted Barley "No. 2" (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Barley, malted, with its dust . .	259*	0·75*	4·36*	303·6*
Clover-chaff	335	0·97	5·91	307·8
Swedes, ad lib.	3,182	9·47	57·65	4,971·9

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	126	132	6	1·50	1·16
2	126	136	10	2·50	
3	105	112	7	1·75	
4	114	105	−9	−2·25	
5	120	130	10	2·50	
6	103	109	6	1·50	
7	119	119	0	0·00	
8	102	110	8	2·00	
9	114	114	0	0·00	
10	104	112	8	2·00	
11	110	116	6	1·50	
12	100	112	12	3·00	
Totals . .	1,343	1,407	64	—	—
Averages .	112	117	5⅓	1·33	1·16

Lot 5.—12 Sheep; Special Food—Unmalted and Malted Barley "No. 2 (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	169	3·30	3·03	163·1
Barley, malted, with its dust . .	84*	0·25*	1·52*	81·6*
Clover-chaff	335	1·00	6·05	325·2
Swedes, ad lib.	3,685	10·80	65·46	3,589·3

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	144	150	6	1·50	1·66
2	126	136	10	2·50	
3	101	110	9	2·25	
4	114	120	6	1·50	
5	108	118	10	2·50	
6	112	119	7	1·75	
7	105	113	6	2·00	
8	114	124	10	2·50	
9	103	112	9	2·25	
10	108	116	8	2·00	
11	99	109	10	2·50	
12	101	111	10	2·50	
Totals . .	1,334	1,437	103	—	—
Averages .	111	120	8⅝	2·15	1·66

* These figures represent not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.

Table XXXVI.—Experiments made with SHEEP, at Rothamsted, Herts.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight.

3rd Period of 4 Weeks; January 27 to February 24, 1864.

—	Food consumed.				Sheep.	Weights, and Increase (or Loss) in Live-weight.				
						Weights.		Increase (or Loss) in Weight.		
	Total in 4 Weeks.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		Jan. 27, 1864.	Feb. 24, 1864.	Total in 4 Weeks.	Per Head per Week.	Per 100 lbs. Live-weight per week.
Lot 2.—12 Sheep; Special Food—Malted Barley "No. 1" (with Saw-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	253	0·75	4·21	213·6	1	126	133	7	1·75	
Clover-chaff	336	1·00	5·61	284·7	2	124	134	10	2·50	
Swedes, ad lib.	3574	10·64	59·59	3028·8	3	122	136	14	3·50	
					4	120	128	8	2·00	
					5	118	128	10	2·50	
					6	110	121	11	2·75	1·97
					7	118	128	10	2·50	
					8	129	140	11	2·75	
					9	112	126	14	3·50	
					10	140	150	10	2·50	
					11	105	110	5	1·25	
					12	114	122	8	2·00	
					Totals	1438	1556	118	—	—
					Averages	120	130	9⅚	2·46	1·97
Lot 1.—12 Sheep; Special Food—Unmalted Barley "No. 1."										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Barley, malted, with its dust	249*	0·74*	4·16*	254·3*	1	126	134	8	2·00	
Clover-chaff	336	1·00	5·63	346·4	2	110	122	12	3·00	
Swedes, ad lib.	3621	10·78	60·65	3733·0	3	114	122	8	2·00	
					4	120	128	8	2·00	
					5	143	155	11	2·75	
					6	136	144	8	2·00	1·62
					7	108	114	6	1·50	
					8	130	136	6	1·50	
					9	128	140	12	3·00	
					10	112	118	6	1·50	
					11	114	122	8	2·00	
					12	110	114	4	1·00	

... Unmalted Barley "No. 2"

	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	262	0·75	4·19	285·0
Clover-chaff	336	1·00	5·59	300·0
Swedes, *ad lib.* . . .	3628	10·78	60·30	2834·8

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	133	147	9	2·25	1·85
2	134	144	10	2·50	
3	134	144	10	2·50	
4	124	132	8	2·00	
5	130	142	12	3·00	
6	117	126	9	2·25	
7	112	114	2	0·50	
8	96	110	12	3·00	
9	132	132	10	2·50	
10	122	133	11	2·75	
11	116	124	9	2·25	
12	100	110	10	2·50	
Totals . .	1446	1556	112	—	—
Averages .	121	130	9⅓	2·33	1·85

Lot 4.—12 Sheep; Special Food—Malted Barley "No. 2 (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Barley, malted, with its dust .	321*	0·75*	4·27*	224·5*
Clover-chaff	319	1·04	5·69	309·7
Swedes, *ad lib.*	3229	11·44	65·05	3419·4

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	132	140	8	2·00	1·90
2	136	147	11	2·75	
3	113	120	8	2·00	
4†	(105)	(95)	(−10)	—	
5	120	140	10	2·50	
6	109	116	7	1·75	
7	119	130	11	2·75	
8	110	122	12	3·00	
9	114	126	12	3·00	
10	112	116	6	1·50	
11	116	128	12	3·00	
12	119	118	6	1·50	
Totals . .	1308	1405	103	—	—
Averages	119	128	9⅓	2·34	1·90

Lot 5.—12 Sheep; Special Food—Unmalted and Malted Barley "No. 2 (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	168	0·60	2·63	175·0
Barley, malted, with its dust .	84*	0·25*	1·41*	377·5*
Clover-chaff	338	1·000	5·65	350·0
Swedes, *ad lib.*	3668	10·78	60·93	3773·9

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	150	163	13	3·25	1·68
2	136	144	8	2·00	
3	110	118	8	2·00	
4	120	126	6	2·00	
5	118	124	8	2·00	
6	119	129	10	2·50	
7	113	123	10	2·50	
8	124	132	6	2·00	
9	112	116	6	1·50	
10	116	122	6	1·50	
11	108	114	6	1·50	
12	111	116	5	1·25	
Totals . .	1437	1533	96	—	—
Averages	120	128	8	2·00	1·68

* These figures represent not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.
† This sheep had been observed to be unwell for about 3 weeks, and was killed on Feb. 3; its proportion of food and weights are excluded in the calculated results given above.

TABLE XXXVII.—EXPERIMENTS made with SHEEP, at ROTHAMSTED, HERTS.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight.

4th Period of 4 Weeks; February 24 to March 23, 1864.

—	Food consumed. Total in 4 Weeks.	Food consumed. Per Head per Day.	Food consumed. Per 100 lbs. Live-weight per Week.	Food consumed. To produce 100 lbs. Increase.	Sheep.	Weights. Feb. 24, 1864.	Weights. March 23, 1864.	Increase in Weight. Total in 4 Weeks.	Increase in Weight. Per Head per Week.	Increase in Weight. Per 100 lbs. Live-weight per Week.
Lot 1.—12 Sheep; Special Food—Unmalted Barley "No. 1."										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	133	137	4	1·00	
					2	134	142	8	2·00	
					3	136	144	8	2·00	
					4	128	133	5	1·25	
					5	128	132	4	1·00	
Barley, unmalted	252	0·75	3·96	375·1	6	131	137	6	1·50	1·05
Clover-chaff	336	1·00	5·28	501·5	7	128	133	5	1·25	
Swedes, ad lib.	4212	12·54	66·25	6286·5	8	140	150	10	2·50	
					9	126	130	4	1·00	
					10	150	154	4	1·00	
					11	110	114	4	1·00	
					12	122	127	5	1·25	
					Totals	1556	1623	67	—	—
					Averages	130	135	5½	1·40	1·05
Lot 2.—12 Sheep; Special Food—Malted Barley "No. 1" (with Malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	134	144	10	2·50	
					2	132	138	6	1·50	
					3	129	135	6	1·50	
					4	128	134	6	1·50	
					5	136	143	7	1·75	
Barley, malted, with its dust	249*	0·74*	3·85*	299·5*	6	144	151	7	1·75	1·31
Clover-chaff	336	1·00	5·21	404·8	7	114	122	8	2·00	
Swedes, ad lib.	4161	12·38	64·74	5013·3	8	126	130	4	1·00	
					9	140	150	10	2·50	
					10	119	125	6	1·50	
					11	122	133	11	2·75	
					12	114	116	2	0·50	

	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	282	0·75	3·65	345·2
Clover-chaff	336	1·00	5·27	450·3
Swedes, *ad lib.*	4151	12·35	69·08	5696·3

2	144	150	6	1·50	1·14
3	144	147	3	0·75	
4	139	149	10	2·50	
5	142	154	12	3·00	
6	126	126	0	0·00	
7	114	114	0	0·00	
8	110	114	4	1·00	
9	132	136	4	1·00	
10	133	142	9	2·25	
11	124	135	11	2·75	
12	110	117	7	1·75	
Totals . .	1558	1631	73	—	—
Averages .	130	136	6	1·52	1·14

Lot 4.—11† Sheep; Special Food—Malted Barley "No. 2" (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Barley, malted, with its dust . .	231*	0·75*	4·09*	308·1*
Clover-chaff	308	1·00	5·37	582·0
Swedes, *ad lib.*	3951	12·60	67·64	6576·0

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	140	142	2	0·50	1·08
2	147	154	7	1·75	
3	130	136	6	1·50	
4†	—	—	—	—	
5	140	147	7	1·75	
6	116	122	6	1·50	
7	130	136	6	1·50	
8	122	130	8	2·00	
9	126	131	5	1·25	
10	118	118	0	0·00	
11	128	136	8	2·00	
12	118	122	4	1·00	
Totals . .	1405	1464	59	—	—
Averages .	128	133	5⅓	1·34	1·08

Lot 5.—12 Sheep; Special Food—Unmalted and Malted Barley "No. 2" (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	169	0·50	2·69	233·3
Barley, malted, with its dust . .	84*	0·25*	1·24*	116·7*
Clover-chaff	336	1·00	5·33	466·7
Swedes, *ad lib.*	4169	12·39	66·32	5780·6

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	163	174	11	2·75	1·15
2	144	144	0	0·00	
3	118	126	8	2·00	
4	128	133	5	1·25	
5	126	130	4	1·00	
6	129	137	8	2·00	
7	123	130	7	1·75	
8	132	136	4	1·00	
9	118	126	8	2·00	
10	122	126	4	1·00	
11	114	119	5	1·25	
12	116	124	8	2·00	
Totals . .	1533	1605	72	—	—
Averages .	128	134	6	1·50	1·15

* These figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.
† No. 4 sheep of this lot (4) was killed Feb. 2. See Note to Table XXXVI.

Table XXXVIII.—Experiments made with SHEEP, at Rothamsted, Herts.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight.

5th Period of 4 Weeks; March 23 to April 20, 1864.

—	Food consumed.				Sheep.	Weights, and Increase (or Loss) in Live-weight.				
						Weights.		Increase (or Loss) in Live-weight.		
	Total in 4 Weeks.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		March 23, 1864.	April 20, 1864.	Total in 4 Weeks.	Per Head per Week.	Per 100 lbs. Live-weight per Week.
Lot 1.—12 Sheep; Special Food—Unmalted Barley "No. 1."										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	336	1·00	5·05	409·8	1	137	142	5	1·25	
Clover-chaff	336	1·00	5·05	409·8	2	142	150	8	2·00	
Roots, ad lib. { Swedes	858	2·55	12·99	1046·3	3	144	154	10	2·50	
Roots, ad lib. { Mangolds	2600	7·74	38·05	3169·5	4	133	137	4	1·00	
					5	132	140	8	2·00	
					6	127	134	7	1·75	1·23
					7	133	140	7	1·75	
					8	130	142	12	3·00	
					9	130	133	3	0·75	
					10	154	161	7	1·75	
					11	114	119	5	1·25	
					12	127	133	6	1·50	
					Totals	1623	1705	82	—	—
					Averages	135	142	6⅚	1·71	1·23
Lot 2.—12 Sheep; Special Food—Malted Barley "No. 1" (with Malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Barley, malted, with its dust	331[e]	0·98[e]	4·97[e]	372·4[e]	1	144	154	10	2·50	
Clover-chaff	336	1·00	5·03	377·5	2	128	136	8	2·00	
Roots, ad lib. { Swedes	827	2·46	12·38	929·2	3	138	146	8	2·00	
Roots, ad lib. { Mangolds	2702	8·04	40·50	3037·1	4	134	140	6	1·50	
					5	163	171	8	2·00	
					6	151	161	10	2·50	1·23
					7	132	136	4	1·00	
					8	130	137	7	1·75	
					9	150	160	10	2·50	
					10	135	138	3	0·75	
					11	133	140	7	1·75	
					12	116	124	8	2·00	
					Totals	1634	1713	79	—	—

	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	336	1·00	5·02	430·8
Clover-chaff	336	1·00	5·03	430·8
Roots, ad lib. { Swedes	598	2·46	12·40	1061·5
Roots, ad lib. { Mangolds	2743	8·16	41·06	3516·7

3	147	[illegible]	[illegible]	[illegible]	1·17
4	142	147	5	2·50	
5	154	164	10	1·00	
6	126	130	4	0·75	
7	114	117	3	1·50	
8	114	120	6	1·00	
9	136	140	4	2·50	
10	142	152	10	1·75	
11	135	142	7	2·20	
12	117	126	9		
Totals	1631	1709	78	—	—
Averages	136	142	6½	1·63	1·17

Lot 4.—11† Sheep; Special Food—Malted Barley No. 2 (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Barley, malted, with its dust	308*	1·06*	5·10*	394·7*
Clover-chaff	308	1·00	5·09	394·2
Roots, ad lib. { Swedes	898	2·79	13·86	882·1
Roots, ad lib. { Mangolds	2334	7·59	35·60	2456·8

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	142	150	8	2·00	1·57
2	154	164	10	2·50	
3	126	134	8	2·00	
4	—	—	—	—	
5	147	157	10	2·50	
6	128	134	6	1·50	
7	136	144	8	2·00	
8	130	140	10	2·50	
9	131	140	9	2·25	
10	118	126	8	2·00	
11	136	146	10	2·50	
12	122	130	8	2·00	
Totals	1464	1559	95	—	—
Averages	133	142	8⅔	2·16	1·57

Lot 5.—12 Sheep; Special Food—Unmalted and Malted Barley "No. 2 (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Barley, unmalted	224	0·67	3·42	367·2
Barley, malted, with its dust	112*	0·33*	1·71*	183·6*
Clover-chaff	336	1·00	5·14	550·8
Roots, ad lib. { Swedes	858	2·55	13·12	1406·5
Roots, ad lib. { Mangolds	2660	7·92	40·66	4360·7

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	174	166	12	3·00	0·93
2	144	126	−18	−4·50	
3	126	130	4	1·00	
4	133	142	9	2·25	
5	130	140	10	2·50	
6	137	145	8	2·00	
7	130	136	6	1·50	
8	136	146	10	2·50	
9	126	134	8	2·00	
10	126	133	7	1·75	
11	119	116	−3	−0·75	
12	124	132	8	2·00	
Totals	1605	1666	61	—	—
Averages	134	139	5	1·27	0·93

* These figures represent not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.
† No. 4 sheep of this lot (4) was killed Feb. 2. *See note to Table XXXVI.*

Table XXXIX.—Experiments made with SHEEP, at Rothamsted, Herts.

Summary of the Weights, and of the Increase in Live-weight.

Total Period, 20 Weeks; December 2, 1863, to April 20, 1864.

Sheep.	Weights at Commencement, Dec. 2, 1863.	Increase (or Loss) in Weight.					Weights at Conclusion, April 20, 1864.	Summary of the Increase in Live-weight.		
		In 4 Weeks; Dec. 2, to Dec. 30, 1863.	In 4 Weeks; Dec. 30, 1863, to Jan. 27, 1864.	In 4 Weeks; Jan. 27, to Feb. 24, 1864.	In 4 Weeks; Feb. 24, to Mar. 23, 1864.	In 4 Weeks; Mar. 23, to April 20, 1864.		Total in 20 Weeks.	Per Head per Week.	Per 100 lbs. Live-weight per Week.
Lot 1.—12 Sheep; Special Food—Unmalted Barley "No. 1."										
Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
1	112	9	6	7	4	4	142	30	1 8	1 3
2	101	14	9	10	8	8	150	49	2 7¼	1 13½
3	101	13	8	14	8	10	154	53	2 10½	2 1½
4	107	7	6	8	5	4	137	30	1 8	1 5½
5	100	6	10	10	4	10	140	40	2 0	1 10½
6	92	13	5	11	6	7	134	42	2 1½	1 13½
7	100	10	8	10	5	7	140	40	2 0	1 10½
8	105	14	10	11	10	12	162	57	2 13½	2 2
9	88	14	10	14	4	3	133	45	2 4	2 0½
10	119	12	9	10	4	7	161	42	2 1½	1 8
11	88	12	5	5	4	5	119	31	1 8¾	1 8
12	94	13	8	8	5	5	133	39	1 15¼	1 11½
Totals . . .	1207	137	94	118	67	82	1,705	498	—	—
Averages . .	101	11½	7¾	9¾	5½	6¾	142	41½	2 1¼	1 11½
Lot 2.—12 Sheep; Special Food—Malted Barley "No. 1" (with Malt-dust).										
Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
1	109	11	6	8	10	10	154	45	2 4	1 11½
2	94	10	9	12	6	6	136	42	2 1½	1 12½
3	98	9	9	8	6	6	138	40	2 0	1 11½
4	100	8	12	8	6	6	140	40	2 0	1 10½
5	119	14	12	11	7	8	171	52	2 9½	1 12½
6	112	14	10	8	7	10	161	49	2 7¼	1 12½
7	94	10	4	6	8	4	126	32	1 9½	1 7¼
8	102	12	6	6	4	7	137	35	1 12	1 7½
9	105	13	10	12	10	10	160	55	2 12	2 1¼
10	94	7	13	6	6	3	128	34	1 11¼	1 8½
11	96	14	4	6	11	7	140	44	2 3¼	1 12½
12	98	14	6	4	3	6	134	36	1 12¾	1 11½

4	114	8	12	10	3	3	130	38	1 1½	1 4½
5	105	11	8	8	10	5	147	42	2 1½	1 10½
6	105	11	14	12	12	10	164	50	2 12½	2 3
7	94	12	11	9	—	4	130	36	1 13½	1 9½
8	94	10	4	9	—	3	117	19	0 15½	0 14½
9	84	7	7	12	4	6	120	30	1 13½	1 13½
10	104	9	10	10	4	4	140	36	1 12½	1 7½
11	104	10	8	11	9	10	152	45	2 6½	1 14
12	88	15	12	9	11	7	142	54	2 1¼	2 5½
	86	7	7	10	7	9	128	40	2 0	1 14½
Totals .	1206	127	113	112	73	79	1,709	504	—	—
Averages . .	100	10½	9½	9¼	6	6½	142	42	2 1¼	1 11¼

Lot 4.—12* Sheep; Special Food—Malted Barley "No. 2" (with Malt-dust),

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
1	119	7	6	8	2	8	150	31	1 6½	1 2½
2	114	12	10	11	7	13	164	50	2 8	1 12½
3	94	11	7	8	6	8	134	40	2 0	1 12
4*	102	13	− 9	(−10*)	—	—	—	(−7*)	—	—
5	109	12	1	10	7	10	157	49	2 7½	1 13½
6	91	12	6	7	6	6	138	37	1 13½	1 11
7	107	12	—	11	6	6	144	37	1 13¼	1 7½
8	91	11	8	12	8	10	140	49	2 7½	2 2
9	102	12	—	12	5	9	140	38	1 14½	1 9
10	94	10	6	6	—	6	128	32	1 9½	1 7½
11	100	10	6	12	8	10	146	46	2 4½	1 14
12	91	9	12	6	4	8	130	39	1 15½	1 12½
Totals . . .	1213	130	64	103	59	95	1,559	448	—	—
Averages . .	101	10¼	5¼	9¼	5¼	8¼	142	40¾	2 0¾	1 10¾

Lot 5.—12 Sheep; Special Food—Unmalted and Malted Barley "No. 2" (with Malt-dust).

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
1	128	16	6	13	11	12	166	38	2 14½	1 13¼
2	114	12	10	8	—	−18	128	12	0 9½	0 8
3	91	10	9	8	8	4	130	39	1 15½	1 13½
4	104	10	6	8	5	9	142	38	1 14½	1 8½
5	94	14	10	8	4	10	140	46	2 4½	1 15½
6	98	16	7	10	8	8	145	49	2 7½	2 0½
7	94	11	8	10	7	6	136	42	2 1½	1 13½
8	102	12	10	8	4	10	144	44	2 3½	1 12½
9	91	12	9	6	8	8	134	43	2 2½	1 14½
10	98	10	8	6	4	7	133	35	1 12	1 8½
11	88	10	10	6	5	− 3	116	28	1 6½	1 6
12	91	10	10	5	8	8	132	41	2 0½	1 13½
Totals . . .	1191	143	103	96	72	61	1,666	475	—	—
Averages . .	99	12	8½	8	6	5	139	39½	1 15½	1 10½

* No. 4 sheep of this lot was killed on February 5, and its weight was only taken into calculation in the total and average results given for the first and second months.

Table XL.—Experiments made with Sheep, at Rothamsted, Herts.

Summary of Food consumed, and Increase yielded, during each separate Month, and during the entire Period of Five Months.

Periods.		Food consumed.									Increase in Weight.	
		Per Head per Week.			Per 100 lbs. Live-weight per Week.			To produce 100 lbs. Increase.				
Dates.	Number of Weeks.	Barley (or Malt.)	Clover-chaff.	Roots.	Barley (or Malt).	Clover-chaff.	Roots.	Barley (or Malt).	Clover-chaff.	Roots.	Per Head per Week.	Per 100 lbs. Live-weight per Week.
Lot 1.—12 Sheep; Special Food—Unmalted Barley "No. 1."												
1863–4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs	lbs.	lbs. ozs.	lbs. ozs.
Dec. 2 to Dec. 30	4	5·3	7·0	76·8	4·94	6·59	72·29	183·9	215·3	2692·0	2 13¼	2 11
Dec. 30 to Jan. 27	4	5·3	7·0	76·3	4·53	6·04	65·85	268·1	357·4	3497·9	1 15¼	1 11
Jan. 27 to Feb. 24	4	5·3	7·0	74·5	4·21	5·61	59·69	213·6	284·7	3028·8	2 7¼	1 15¼
Feb. 24 to Mar. 23	4	5·3	7·0	87·7	3·96	5·28	66·25	376·1	501·5	6286·6	1 6¼	1 0¾
Mar. 23 to April 20	4	7·0	7·0	72·0	5·05	5·05	51·94	409·8	409·8	4215·8	1 11¼	1 3¼
Dec. 2 to April 20	20	5·6	7·0	77·5	4·62	5·77	63·86	269·9	337·3	3733·9	2 1¼	1 11¼
Lot 2.—12 Sheep; Special Food—Malted Barley "No. 1" (with Malt-dust).												
1863–4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs	lbs.	lbs.	lbs. ozs.	lbs. ozs.
Dec. 2 to Dec. 30	4	*5·2	7·0	76·9	*4·87	6·58	72·30	*182·7	247·1	2715·4	2 13¼	2 10¼
Dec. 30 to Jan. 27	4	*5·2	7·0	76·7	*4·46	6·02	66·03	*251·1	339·4	3720·2	2 1	1 12¼
Jan. 27 to Feb. 24	4	*5·2	7·0	75·4	*4·16	5·63	60·65	*256·3	346·4	3733·0	2 0¼	1 10
Feb. 24 to Mar. 23	4	*5·2	7·0	86·7	*3·93	5·31	65·71	*299·5	404·8	5013·3	1 11¼	1 5
Mar. 23 to April 20	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 8¼	[illegible]
Mar. 23 to April 20 . . .	4	7·0	7·0	74·4	5·03	5·03	53·46	430·8	430·8	4578·2	1 10	1 2¼
												1 2⅝
Dec. 2 to April 20 . . .	20	5·6	7·0	78·0	4·61	5·76	64·19	267·2	334·0	3720·1	2 1¼	1 11¼

Lot 4.—12† Sheep; Special Food—Malted Barley "No. 2" (with Malt-dust).

1863–4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
Dec. 2 to Dec. 30 . . .	4	*5·3	7·0	76·4	*4·93	6·57	71·75	*193·8	258·5	2821·5	2 11¾	2 8¾
Dec. 30 to Jan. 27 . . .	4	*5·3	6·8	66·3	*4·58	5·91	57·85	*393·8	507·8	4971·9	1 5¾	1 2¼
Jan. 27 to Feb. 24 . . .	4	*5·3	7·2	80·0	*4·27	5·89	65·05	*224·5	309·7	3419·4	2 5¼	1 14¼
Feb. 24 to Mar. 23 . . .	4	*5·3	7·0	88·2	*4·03	5·37	67·64	*392·1	522·0	6578·0	1 5¼	1 0¼
Mar. 23 to April 20 . . .	4	*7·0	7·0	72·1	*5·10	5·09	52·46	*324·7	324·2	3338·9	2 2¼	1 9¼
Dec. 2 to April 20 . . .	20	*5·6	7·0	76·6	*4·61	5·77	63·12	*275·0	343·9	3762·1	2 0⅝	1 10⅜

Lot 5.—12 Sheep; Special Food—Unmalted and Malted Barley "No. 2" (with Malt-dust).

1863–4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
Dec. 2 to Dec. 30 . . .	4	‡5·3	7·0	76·4	‡4·99	6·65	72·63	‡176·2	235·0	2565·0	2 15¾	2 13¼
Dec. 30 to Jan. 27 . . .	4	‡5·3	7·0	75·6	‡4·55	6·06	65·46	‡244·7	326·2	3522·3	2 2¼	1 13¾
Jan. 27 to Feb. 24 . . .	4	‡5·3	7·0	75·5	‡4·24	5·66	60·98	‡262·5	350·0	3772·9	2 0	1 9¾
Feb. 24 to Mar. 23 . . .	4	‡5·3	7·0	86·7	‡4·02	5·35	66·32	‡350·0	466·7	5780·6	1 8	1 2¼
Mar. 23 to April 20 . . .	4	‡7·0	7·0	73·3	‡5·13	5·14	53·78	‡550·8	550·8	5767·2	1 4¼	0 15
Dec. 2 to April 20 . .	20	‡5.6	7·0	77·5	‡4·71	5·88	65·10	‡282·9	353·7	3915·4	1 15⅝	1 10⅜

* These figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.

† No. 4 sheep of this lot (4) was killed February 3, and its consumption of food, and weights, are only taken into account in the results given for the first two months.

‡ Two thirds of these amounts represent unmalted barley, and the remaining one-third the amount of barley from which the malt and malt-dust given would be produced.

TABLE XLI.—EXPERIMENTS made with SHEEP, at ROTHAMSTED, HERTS.

Weights of the Carcasses, and some other Separated Parts.

Lot 1.—Special Food—Unmalted Barley "No. 1."

Designation of Parts.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	No. 11	No. 12	Mean
	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
Caul fat	5 8	5 12	6 0	5 12	5 12	6 12	6 4	4 8	4 4	5 12	5 0	5 0	5 [illegible]
Intestinal fat	4 8	5 0	5 0	4 0	4 12	4 0	4 8	4 12	3 12	5 8	6 8	6 14	4 [illegible]
Skin and wool	18 0	17 0	17 0	16 0	18 0	17 0	16 0	23 0	16 0	19 0	17 0	18 0	17 10[illegible]
Total	28 0	27 12	28 0	25 12	28 8	27 12	26 12	32 4	24 0	30 4	28 8	29 14	27 [illegible]
Other offal parts, loss by fasting, evaporation, &c.	41 0	48 4	47 0	38 4	42 8	42 4	39 4	46 12	56 0	48 12	30 8	39 4	41 [illegible]
Carcass (cold)	73 0	74 0	79 0	73 0	69 0	64 0	74 0	84 0	78 0	82 0	60 0	74 0	76 4
Live-weight) unfasted)	142 0	150 0	154 0	137 0	140 0	134 0	140 0	162 0	158 0	161 0	119 0	143 0	149 1[illegible]

Lot 2.—Special Food—Malted Barley "No. 1" (with Malt-dust).

Designation of Parts.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	No. 11	No. 12	Mean
	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
Caul fat	7 0	3 12	4 12	6 0	4 12	6 4	5 12	5 0	5 0	5 0	4 4	4 8	5 [illegible]
Intestinal fat	3 12	2 8	3 12	4 4	5 0	4 4	4 0	4 0	5 8	3 12	4 4	3 4	4 [illegible]
Skin and wool	18 0	20 0	17 0	15 0	21 0	22 0	15 0	19 0	18 0	16 0	15 0	18 0	17 [illegible]
Total	28 12	26 4	25 8	25 4	30 12	32 8	24 12	28 0	28 8	24 12	23 8	26 12	27 [illegible]
Other offal parts, loss by [illegible]										[illegible] 4	41 8	34 4	42 3[illegible]

			18 0	5 4	3 12	3 4	4 0	3 8	4 0				
		16 0		18 0	21 0	16 0	18 0	17 0	15 0	21 0	20 0	16 0	
Total	28 12	25 4	29 0	26 12	29 0	22 12	26 8	23 12	24 4	32 8	27 4	23 4	26 9¾
Other offal parts, loss by fasting, evaporation, &c.	47 4	51 12	37 0	39 4	50 0	38 4	26 8	33 4	39 12	43 8	43 12	35 12	40 5¾
Carcass (cold)	87 0	81 0	84 0	81 0	85 0	71 0	64 0	63 0	76 0	76 0	71 0	67 0	75 8
Live-weight (unfasted)	163 0	158 0	150 0	147 0	164 0	130 0	117 0	120 0	140 0	152 0	142 0	126 0	142 6¼

Lot 4.—Special Food—Malted Barley "No. 2" (with Malt-dust).

	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
Caul fat	4 12	5 4	4 4	*	5 4	3 8	4 4	4 8	4 0	4 8	3 12	3 8	4 5
Intestinal fat	4 0	4 8	3 0		3 8	3 8	4 8	3 8	3 12	5 8	3 0	4 4	4 0
Skin and wool	21 0	20 0	16 0		20 0	15 0	20 0	19 0	18 0	18 0	19 0	19 0	18 10¼
Total	29 12	30 12	23 4		28 12	22 0	28 12	27 0	25 12	28 0	25 12	26 12	26 15¼
Other offal parts, loss by fasting, evaporation, &c.	47 4	53 4	42 12		47 4	40 4	44 0	44 0	40 4	28 0	45 4	36 4	42 9¼
Carcass (cold)	73 0	80 0	68 0		11 0	66 0	71 0	69 0	74 0	70 0	75 0	67 0	72 2¾
Live-weight (unfasted)	150 0	164 0	134 0		157 0	128 0	144 0	140 0	140 0	126 0	146 0	130 0	141 11¼

Lot 5.—Special Food—Barley "No. 2," ¾ Unmalted and ¼ Malted (with Malt-dust).

	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
Caul fat	6 4	6 4	4 8	5 4	4 12	6 4	5 0	5 4	5 8	5 8	4 8	4 8	5 4¾
Intestinal fat	6 4	4 0	3 12	5 0	3 8	4 4	4 8	4 0	5 4	5 4	4 4	3 4	4 7
Skin and wool	22 0	15 0	16 0	21 0	15 0	20 0	20 0	20 0	17 0	21 0	18 0	18 0	18 9¼
Total	34 8	25 0	24 4	31 4	23 4	30 8	29 8	29 4	27 12	31 12	26 12	25 12	28 5
Other offal parts, loss by fasting, evaporation, &c.	54 8	34 12	38 12	38 12	50 12	39 8	37 8	37 12	36 4	35 4	31 4	37 4	39 5¼
Carcass (cold)	97 0	66 0	67 0	73 0	66 0	75 0	69 0	79 0	70 0	66 0	51 0	69 0	71 2¾
Live-weight (unfasted)	186 0	126 0	130 0	142 0	140 0	145 0	136 0	146 0	134 0	133 0	116 0	132 0	138 13¾

* No. 4 sheep of Lot 4 was killed on February 3; it had been unwell about three weeks.

Table XLII.—Experiments made with Sheep, at Rothamsted, Herts.

Per-centages of the Carcasses, and some other separated Parts, in the Live-weights (unfasted).

Designation of Parts.	SHEEP.												
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	No. 11.	No. 12.	Means.
Lot 1.—Special Food—Unmalted Barley "No. 1."													
Caul fat	3·87	3·84	3·90	4·20	4·11	5·04	4·46	2·78	3·20	3·67	4·20	3·76	3·91
Intestinal fat	3·17	3·33	3·25	2·92	3·39	2·98	3·22	2·93	2·82	3·42	2·94	2·82	3·10
Skin and wool	12·68	11·33	11·04	11·88	12·86	12·69	11·43	14·20	12·03	11·80	14·29	13·53	12·46
Total	19·72	18·50	18·19	18·80	20·36	20·71	19·11	19·91	18·05	18·79	21·43	20·11	19·47
Other offal parts, loss by fasting, evaporation, &c.	28·87	32·17	30·42	27·92	30·36	31·53	28·04	28·24	27·07	30·28	28·16	24·25	28·88
Carcass (cold)	51·41	49·33	51·39	53·28	49·28	47·76	52·85	51·85	54·88	50·93	50·42	55·64	51·68
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Lot 2.—Special Food—Malted Barley "No. 1" (with Malt-dust).													
Caul fat	4·55	2·76	3·49	4·28	2·78	3·88	4·56	3·65	3·12	3·91	3·04	3·63	3·64
Intestinal fat	2·43	1·64	2·76	3·04	2·92	2·64	3·18	2·92	3·44	2·93	3·04	2·62	2·81
Skin and wool	11·69	14·71	12·50	10·71	12·28	13·67	11·91	13·87	11·25	12·60	10·71	14·62	12·53
Total	18·67	19·31	18·75	18·03	17·98	20·19	19·65	20·44	17·81	19·34	16·79	20·77	18·98
Other offal parts, loss by	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	2·91	3·64	3·83	2·38	2·59	2·69	3·85	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Intestinal fat	3·07	2·21	3·50	3·57	2·29	2·50	3·42	2·92	3·22	3·29	[illegible]	[illegible]	[illegible]
Skin and wool	11·66	10·13	12·00	12·25	12·80	12·31	15·38	14·17	10·72	13·81	14·08	12·70	12·67
Total	17·64	15·98	19·33	18·20	17·68	17·50	22·65	19·79	17·33	21·38	19·19	18·46	18·76
Other offal parts, lost by fasting, evaporation, &c.	28·99	32·75	24·67	26·70	30·49	27·89	22·65	27·71	28·39	28·62	30·81	28·37	28·17
Carcass (cold)	53·37	51·27	56·00	55·10	51·83	54·61	54·70	52·50	54·28	50·00	50·00	53·17	53·07
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Lot 4.—Special Food—Malted Barley "No. 2" (with Malt-dust).

Caul fat	3·17	3·21	3·17	*	3·24	2·74	2·95	3·21	2·86	3·57	2·57	2·69	3·04
Intestinal fat	2·66	3·35	2·24		2·23	2·73	3·13	2·50	2·69	4·36	2·06	3·27	2·85
Skin and wool	14·00	12·19	11·94		12·74	11·72	13·89	13·57	12·87	14·29	13·01	14·62	13·16
Total	19·83	18·75	17·35		18·31	17·19	19·97	19·28	18·42	22·22	17·64	20·58	19·05
Other offal parts, loss by fasting, evaporation, &c.	31·50	32·47	31·90		30·10	31·25	30·72	31·43	28·72	22·22	30·99	27·88	29·92
Carcass (cold)	48·67	48·78	50·75		51·59	51·56	49·31	49·29	52·86	55·56	51·37	51·54	51·03
	100·00	100·00	100·00		100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Lot 5.—Special Food—Barley "No. 2" ⅔ Unmalted and ⅓ Malted (with Malt-dust).

Caul fat	3·36	4·96	3·46	3·70	3·39	4·31	3·67	3·59	4·10	4·14	3·88	3·41	3·83
Intestinal fat	3·36	3·18	2·88	3·52	2·50	2·93	3·31	2·74	3·92	3·95	3·66	2·46	3·20
Skin and wool	11·83	11·90	12·31	14·79	10·72	13·80	14·71	13·70	12·69	15·79	15·52	13·64	13·45
Total	18·55	20·04	18·65	22·01	16·61	21·04	21·69	20·03	20·71	23·88	23·06	19·51	20·48
Other offal parts, loss by fasting, evaporation, &c.	29·30	27·58	29·81	27·29	36·25	27·24	27·57	25·86	27·05	26·50	26·94	28·22	28·30
Carcass (cold)	52·15	52·38	51·54	50·70	47·14	51·72	50·74	54·11	52·24	49·62	50·00	52·27	51·22
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

* No. 4 sheep of Lot 4 was killed February 3; it had been unwell about 3 weeks.

Table XLIII.—Experiments mad with Pigs, at Rothamsted, Herts.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight. 1st Period of 2 Weeks; Dec. 24, 1863, to Jan. 7, 1864.

—	Food consumed. Total in 2 Weeks.	Food consumed. Per Head per Day.	Food consumed. Per 100 lbs. Live-weight per Week.	Food consumed. To produce 100 lbs. Increase.	Pigs.	Weights. Dec. 24, 1863.	Weights. Jan. 7, 1864.	Increase in Live-weight. Total in 2 Weeks.	Increase in Live-weight. Per Head per Week.	Increase in Live-weight. Per 100 lbs. Live-weight per Week.
Lot 1.—8 Pigs; Food—Pea-meal, and Unmalted Barley "No. 2."										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Pea-meal	112	1·0	4·56	40.9	1	158	182	24	12·0	11·20
Barley, unmalted, ad lib. . . .	900	8·0	36·79	328·5	2	160	198	38	19·0	
					3	133	166	33	16·5	
					4	134	172	38	19·0	
					5	135	161	26	13·0	
					6	122	161	39	19·5	
					7	122	160	38	19·0	
					8	122	160	38	19·0	
					Totals . .	1086	1360	274	—	—
					Averages .	136	170	34¼	17·1	11·20
Lot 2.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 1" (with Malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Pea-meal	112	1·0	4·75	60·5	1	172	189	17	8·5	7·84
Barley, malted, with its dust, ad lib.	887*	7·9*	37·60*	479·5*	2	144	168	24	12·0	
					3	142	164	22	11·0	
					4	133	168	35	17·5	
					5	130	161	31	15·5	
					6	124	140	16	8·0	
					7	119	142	23	11·5	
					8	123	140	17	8·5	
					Totals . .	1087	1272	185	—	—
					Averages .	136	159	23⅛	11·6	7·84
Lot 3.—8 Pigs; Food—Pea-meal, Unmalted and Malted Barley "No. 1" (with Malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Pea-meal	112	1·0	4·65	55·3	1	147	174	27	13·5	8·43
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	150	178	28	14·0	
					3	150	168	18	9·0	
					4	144	175	31	15·5	
					5	129	154	25	12·5	
					6	130	158	28	14·0	

	lbs.	lbs.	lbs.	lbs.						
Pea-meal	112	1·0	4·66	20·3	1	[illegible]	[illegible]	26	19·0	9·31
Barley, unmalted, ad lib.	800	7·1	33·40	306·7	2	147	179	29	14·0	
					3	142	170	31	15·5	
					4	140	171	30	15·0	
					5	136	166	29	14·0	
					6	126	154	28	14·0	
					7	133	161	28	14·0	
					8	112	140	29		
					Totals	1086	1309	223	—	—
					Averages	136	164	27⅞	13·9	9·31

Lot 5.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 2" (with Malt-dust).

					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
	lbs.	lbs.	lbs.	lbs.	1	156	170	14	7·0	7·21
Pea-meal	112	1·0	4·67	64·7	2	152	168	30	15·0	
Barley, malted, with its dust, ad lib.	959*	8·4*	39·10*	342·3*	3	150	175	25	12·5	
					4	130	147	17	8·5	
					5	135	161	26	13·0	
					6	126	164	38	19·0	
					7	134	140	6	3·0	
					8	130	147	17	8·5	
					Totals	1113	1286	173	—	—
					Averages	139	161	21⅝	10·6	7·21

Lot 6.—8 Pigs; Food—Pea-meal, and Mixture of four-fifths Unmalted and one-fifth Malted Barley "No. 2" (with Malt-dust *ad lib.*

					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
	lbs.	lbs.	lbs.	lbs.	1	168	206	38	19·0	9·61
Pea-meal	112	1·0	4·62	48·1	2	157	192	35	17·5	
Barley, unmalted	700	6·3	28·87	300·4	3	133	163	30	15·0	
Barley, malted, with its dust	175*	1·6*	7·22*	75·1*	4	128	163	35	17·5	
					5	134	134	0	0·0	
					6	136	170	34	17·0	
					7	138	161	23	16·5	
					8	112	140	28	14·0	
					Totals	1096	1329	233	—	—
					Averages	137	166	29⅛	14·6	9·61

* These figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.

Table XLIV.—Experiments made with Pigs, at Rothamsted, Herts.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight. 2nd Period of 2 Weeks; Jan. 7 to Jan. 21, 1864.

	Food consumed. Total in 2 Weeks.	Food consumed. Per Head per Day.	Food consumed. Per 100 lbs. Live-weight per Week.	Food consumed. To produce 100 lbs. Increase.	Pigs.	Weights. Jan. 7, 1864.	Weights. Jan. 21, 1864.	Increase in Live-weight. Total in 2 Weeks.	Increase in Live-weight. Per Head per Week.	Increase in Live-weight. Per 100 lbs. Live-weight per Week.
Lot 1.—8 Pigs; Food—Pea-meal, and Unmalted Barley "No. 1."										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	160	214	36	18·0	
					2	150	218	34	17·0	
Pea-meal	112	1·0	3·73	30·7	3	166	196	30	15·0	
Barley, unmalted, *ad lib.*	1000	8·9	33·31	334·6	4	172	218	40	20·0	9·59
					5	161	189	30	14·0	
					6	161	208	47	23·5	
					7	160	189	29	14·5	
					8	160	197	39	19·5	
					Totals	1360	1639	285		
					Average	170	205	36½	17·8	9·59
Lot 2.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 1" (with Malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	169	204	35	17·5	
					2	169	198	29	14·5	
Pea-meal	112	1·0	4·08	46·9	3	164	193	29	14·5	
Barley, malted, with its dust, *ad lib.*	1044*	9·3*	37·88*	436·9*	4	168	200	32	16·0	8·88
					5	161	184	23	11·5	
					6	160	174	34	17·0	
					7	149	188	39	19·5	
					8	140	164	24	12·0	
					Totals	1272	1511	239	—	
					Average	159	189	29⅞	14·9	8·88
Lot 3.—7† Pigs; Food—Pea-meal, Unmalted and Malted Barley "No. 1" (with Malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	174	208	34	17·0	
					2	178	210	32	16·0	
Pea-meal	98	1·0	3·81	45·3	3†	(168)	(162)	(−6)		
Barley, unmalted, *ad lib.*	606	6·7	26·15	281·4	4	179	213	37	18·5	9·20
Barley, malted, *ad lib.*	210*	2·0*	7·97*	96·7*	5	164	184	30	15·0	
					6	158	193	34	17·0	
					7	160	196	36	18·0	
					8	140	165	25	12·5	
					Totals	1157	1370	228		
					Average	[illegible]	[illegible]	[illegible]	16·0	9·20

	lbs.	lbs.	lbs.	lbs.
Pea-meal	112	1·0	3·87	40·9
Barley, unmalted, *ad lib.*	938	8·4	32·43	342·3

1	[illegible]	[illegible]	[illegible]	[illegible]	
2	172	208	30	[illegible]	
3	170	208	38	19·0	
4	171	206	86	17·5	9·47
5	166	198	38	16·0	
6	154	184	30	15·0	
7	161	194	33	16·5	
8	140	175	35	17·5	
Totals . .	1309	1583	274	—	—
Averages .	164	198	34¼	17·1	9·47

Lot 5.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 2" (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Pea-meal	112	1·0	3·93	40·4
Barley, malted, with its dust, *ad lib.*	1072*	9·6*	37·63*	387·1*

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	170	210	40	20·0	
2	182	224	42	21·0	
3	175	214	39	19·5	
4	147	178	31	15·5	9·72
5	161	193	32	16·0	
6	164	196	32	16·0	
7	140	168	28	14·0	
8	147	180	33	16·5	
Totals . .	1286	1563	277	—	—
Averages .	161	195	34⅝	17·3	9·72

Lot 6.—7‡ Pigs; Food—Pea-meal, and Mixture of four-fifths Unmalted and one-fifth Malted Barley "No. 2" (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.
Pea-meal	98	1·0	3·74	43·2
Barley, unmalted	738$\frac{5}{16}$	7·5	28·21	325·2
Barley, malted, with its dust . .	185*	1·9	7·05*	81·3

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
1	206	250	44	22·0	
2	192	232	40	20·0	
3	163	192	29	14·5	
4	163	194	31	15·5	8·67
5‡	—	—	—	—	
6	170	200	30	15·0	
7	161	188	27	13·5	
8	140	166	26	13·0	
Totals . .	1125	1422	227	—	—
Averages .	171	203	32³⁄₇	16·2	8·67

* These figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.

† No. 3 pig of this lot (3) being unwell, was killed Jan. 14, and its proportion of food and weight are excluded in the calculated results given above.

‡ No. 5 pig of this lot (6) being unwell, was killed Jan. 7, so that the results relate to 7 pigs only.

Table XLV.—Experiments made with Pigs, at Rothamsted, Herts.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight. 3rd Period of 2 Weeks; Jan. 21 to Feb. 4, 1864.

	Food consumed.				Pigs.	Weights and Increase in Live-weight.				
						Weights.		Increase in Live-weight.		
	Total in 2 Weeks.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		Jan. 21, 1864.	Feb. 4, 1864.	Total in 2 Weeks.	Per Head per week.	Per 100 lbs. Live-weight per week.
Lot 1.—8 Pigs; Food—Pea-meal, and Unmalted Barley "No. 1."										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Pea-meal	112	1·0	3·20	51·1	1	219	242	24	12·0	6·25
Barley, unmalted, *ad lib.*	1,010	9·0	28·88	461·2	2	236	269	33	16·5	
					3	198	226	28	14·0	
					4	212	234	22	11·0	
					5	189	218	29	14·5	
					6	208	238	30	15·0	
					7	189	210	21	10·5	
					8	192	224	32	16·0	
					Totals	1,643	1,861	219	—	—
					Averages	205	233	27⅜	13·7	6·25
Lot 2.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 1" (with Malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Pea-meal	112	1·0	3·51	65·9	1	224	250	26	13·0	5·38
Barley, malted, with its dust, *ad lib.*	974*	8·7*	30·51*	572·9*	2	198	224	26	13·0	
					3	193	212	19	9·5	
					4	206	231	25	12·5	
					5	184	200	16	8·0	
					6	174	198	24	12·0	
					7	168	186	18	9·0	
					8	164	180	16	8·0	
					Totals	1,511	1,681	170	—	—
					Averages	189	210	21¼	10·6	5·38
Lot 3.—7† Pigs; Food—Pea-meal, Unmalted and Malted Barley "No. 1" (with Malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Pea-meal	94	1·0	3·35	53·3	1	208	231	23	11·5	6·29
Barley, unmalted, *ad lib.*	770	7·9	26·64	423·4	2	210	238	28	14·0	
					3†	—	—	—	—	
					4	212	238	26	13·0	
					5	184	210	26	13·0	
					6	204	224	20	10·0	
					7	196	224	28	14·0	

	lbs.	lbs.	lbs.	lbs.	1	210	231	21	[illegible]	6.06
Pea-meal	112	1·0	3·42	54·9	2	208	231	23	11·5	
Barley, unmalted, *ad lib.*	890	7·9	26·41	436·3*	3	208	245	37	18·5	
					4	206	231	25	12·5	
					5	198	217	19	9·5	
					6	184	203	19	9·5	
					7	194	226	32	16·0	
					8	175	203	28	14·0	
					Totals . .	1,583	1,787	204	—	—
					Averages .	198	223	25½	12·8	6·06

Lot 5.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 2" (with Mult-dust).

					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
	lbs.	lbs.	lbs.	lbs.	1	210	234	24	12·0	6·01
Pea-meal	112	1·0	3·37	56·0	2	224	248	24	12·0	
Barley, malted, with its dust, *ad lib.*	1,137*	10·1*	34·18*	568·4*	3	214	245	31	15·5	
					4	178	192	14	7·0	
					5	193	220	27	13·5	
					6	196	224	28	14·0	
					7	168	194	26	13·0	
					8	180	206	26	13·0	
					Totals . .	1,563	1,763	200	—	—
					Averages .	195	220	25	12·5	6·01

Lot 6.—7‡ Pigs; Food—Pea-meal and Mixture of four-fifths Unmalted and one-fifth Malted Barley "No. 2" (with Malt-dust).

					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
	lbs.	lbs.	lbs.	lbs.	1	250	284	34	17·0	6·20
Pea-meal	98	1·0	3·23	52·1	2	232	262	30	15·0	
Barley, unmalted	$738\frac{11}{16}$	7·5	24·36	392·9	3	192	212	20	10·0	
Barley, malted, with its dust . .	185*	1·7*	6.11*	98·5*	4	194	224	30	15·0	
					5‡	—	—	—	—	
					6	200	222	22	11·0	
					7	188	212	24	12·0	
					8	166	194	28	14·0	
					Totals . .	1,422	1,610	188	—	—
					Averages .	203	230	$26\frac{6}{7}$	13·4	6·20

* These figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.

† No. 3 pig of this lot (3) having been killed the results relate to 7 pigs only.

‡ No. 5 pig of this lot (6) having been killed the results relate to 7 pigs only.

TABLE XLVI.—EXPERIMENTS made with PIGS, at ROTHAMSTED, HERTS.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight. 4th Period of 2 Weeks; Feb. 4 to Feb. 18, 1864.

—	Food consumed.				Pigs.	Weights, and Increase in Live-weight.				
						Weights.		Increase in Live-weight.		
	Total in 2 Weeks.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		Feb. 4, 1864.	Feb. 18, 1864.	Total in 2 Weeks.	Per Head per Week.	Per 100 lbs. Live-weight per Week.
Lot 1.—8 Pigs; Food—Pea-meal, and Unmalted Barley "No. 2."										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Pea-meal	112	1·0	2·85	53·6	1	242	267	25	12·5	5·29
Barley, unmalted, *ad lib.*	966	8·6	24·36	464·4	2	269	304	35	17·5	
					3	226	242	16	8·0	
					4	234	262	28	14·0	
					5	218	244	26	13·0	
					6	238	270	32	16·0	
					7	210	228	18	9·0	
					8	224	252	28	14·0	
					Totals	1861	2069	208	—	—
					Averages	233	259	26	13·0	5·29
Lot 2.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 1" (with Malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Pea-meal	112	1·0	3·21	57·5	1	250	262	12	6·0	3·67
Barley, malted, with its dust, *ad lib.*	833*	7·4*	23·88*	651·0*	2	224	252	28	14·0	
					3	212	231	19	9·5	
					4	231	247	16	8·0	
					5	200	210	10	5·0	
					6	198	216	18	9·0	
					7	186	202	16	8·0	
					8	180	189	9	4·5	
					Totals	1681	1809	128	—	—
					Averages	210	226	16	8·0	3·67
Lot 3.—7 † Pigs; Food—Pea-meal, Unmalted and Malted Barley "No. 1" (with Malt-dust).										
	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
Pea-meal	98	1·0	2·98	54·4	1	231	259	28	14·0	5·47
Barley, unmalted, *ad lib.*	800	8·2	24·33	444·4	2	239	260	22	11·0	
					3†	—	—	—	—	
					4	238	259	21	10·5	
					5	210	242	32	16·0	
					6	224	248	24	12·0	
					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

	lbs.	lbs.	lbs.	lbs.	3	243	276	33	19·5	5·43
Pea-meal	112	1·0	2·98	54·6	4	231	254	23	11·5	
Barley, unmalted, *ad lib.*	929	8·2	24·40	499·6	5	217	240	23	11·5	
					6	203	236	23	11·5	
					7	226	250	24	12·0	
					8	203	231	28	14·0	
					Totals	1787	1992	205	—	—
					Averages	223	249	25½	12·8	5·43

Lot 5.—8 Pigs; Food—Pea-meal, and Malted Barley No. 2 (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.	Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	234	266	32	16·0	5·53
					2	248	273	25	12·5	
					3	245	273	28	14·0	
Pea-meal	112	1·0	3·00	54·4	4	192	217	25	12·5	
Barley, malted, with its dust, *ad lib.*	1091*	2·7*	29·25*	529·6*	5	220	242	22	11·0	
					6	224	250	26	13·0	
					7	194	217	23	11·5	
					8	206	231	25	12·5	
					Totals	1763	1969	206	—	—
					Averages	220	246	26	12·2	5·53

Lot 6.—6‡ Pigs; Food—Pea-meal, and Mixture of four-fifths Unmalted and one-fifth Malted Barley "No. 2 (with Malt-dust).

					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	262	315	31	15·5	5·10
	lbs.	lbs.	lbs.	lbs.	2‡	(262)	—	—	—	
Pea-meal	84	1·0	2·96	37·9	3	212	232	20	10·0	
Barley, unmalted	565	6·7	19·93	390·4	4	224	245	21	10·5	
Barley, malted, with its dust	141*	1·7*	4·98*	97·6*	5‡	—	—	—	—	
					6	222	253	30	15·0	
					7	212	232	20	10·0	
					8	194	217	23	11·5	
					Totals	1348	1493	145	—	—
					Averages	225	249	24	12·1	5·10

* These figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.
† No. 3 pig of this lot (3) having been killed the result relates to seven pigs only.
‡ No. 2 pig of this lot (6) having been killed on February 6th, and No. 5 pig on January 7th, the results relate to six pigs only

Table XLVII.—Experiments made with Pigs, at Rothamsted, Herts.

Detailed Record of the Food consumed, of the Weights, and of the Increase in Live-weight. 5th Period of 2 Weeks; Feb. 18 to March 3, 1864.

—	Food consumed.				Pigs.	Weights, and Increase in Live-weight.				
						Weights.		Increase in Live-weight.		
	Total in 2 Weeks.	Per Head per Day.	Per 100 lbs. Live-weight per Week.	To produce 100 lbs. Increase.		Feb. 18, 1864.	March 3, 1864.	Total in 2 Weeks.	Per Head per Week.	Per 100 lbs. Live-weight per Week.
Lot 1.—8 Pigs; Food—Pea-meal, and Unmalted Barley "No. 1."										
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
	lbs.	lbs.	lbs.	lbs.	1	267	287	20	10·0	
Pea-meal	112	1·0	2·59	56·0	2	304	336	32	16·0	
Barley, unmalted, ad lib.	1036	9·2	23·69	531·6	3	242	264	22	11·0	
					4	262	287	25	12·5	4·46
					5	244	270	26	13·0	
					6	270	297	27	13·5	
					7	228	241	13	6·5	
					8	252	280	28	14·0	
					Totals	2069	2262	193	—	—
					Averages	259	283	24⅛	12·1	4·46
Lot 2.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 1" (with Malt-dust).										
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
	lbs.	lbs.	lbs.	lbs.	1	262	290	28	14·0	
Pea-meal	112	1·0	2·01	108·7	2	252	278	26	13·0	
Barley, malted, with its dust, ad lib.	643*	5·7*	17·28*	624·1*	3	231	242	11	5·5	
					4	247	240	—7	—3·5	2·70
					5	210	224	14	7·0	
					6	216	228	12	6·0	
					7	202	214	12	6·0	
					8	189	196	7	3·5	
					Totals	1809	1912	103	—	—
					Averages	226	239	12⅞	6·4	2·70
Lot 3.—7† Pigs; Food—Pea-meal, Unmalted and Malted Barley "No. 1" (with Malt-dust).										
					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	239	260	21	10·5	
	lbs.	lbs.	lbs.	lbs.	2	260	287	27	13·5	
					3†	—	—	—	—	
Pea-meal	98	1·0	2·60	33·6	4	239	262	23	11·5	5·01
					5	242	273	31	15·5	
					6	248	280	32	16·0	

	lbs.	lbs.	lbs.	lbs.	2	260	[illegible]	[illegible]	14·0	4·08
Pea-meal	112	1·0	2.70	67·1	3	278	306	28	8·0	
Barley, unmalted, *ad lib.*	976½	8·7	23·58	584 7	4	256	262	6	9·5	
					5	240	259	19	9·5	
					6	226	245	19	15·0	
					7	250	280	30	10·5	
					8	231	252	21		
					Totals . .	1992	2159	167	—	—
					Averages .	240	270	20⅞	10·4	4·08

Lot 5.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 2" (with Malt-dust).

					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	266	284	18	9·0	
	lbs.	lbs.	lbs.	lbs.	2	273	294	21	10·5	
					3	273	298	25	12·5	
Pea-meal	112	1·0	2·74	73·2	4	217	234	17	8·5	3·74
					5	242	262	20	10·0	
Barley, malted, with its dust, *ad lib.*	1049*	9·4*	25·64*	685·7*	6	250	270	20	10·0	
					7	217	228	11	5·5	
					8	231	252	21	10·5	
					Totals . .	1969	2122	153	—	—
					Averages .	246	265	19⅛	9·6	3·74

Lot 6.—6‡ Pigs; Food—Pea-meal, and Mixture of four-fifths Unmalted and one-fifth Malted Barley "No. 2" (with Malt-dust).

					Nos.	lbs.	lbs.	lbs.	lbs.	lbs.
					1	315	350	35	17·5	
	lbs.	lbs.	lbs.	lbs.	2‡	—	—	—	—	
					3	232	250	18	9·0	
Pea-meal	84	1·0	2·68	56·8	4	245	270	25	12·5	4·72
					5‡	—	—	—	—	
Barley, unmalted	572	6·8	18·25	386·5	6	252	283	31	15·5	
					7	232	250	18	9·0	
Barley, malted, with its dust . .	142*	1·7*	4·53*	95·9*	8	217	238	21	10·5	
					Totals . .	1493	1641	148	. .	. .
					Averages .	249	274	24⅔	12·3	4·72

* These figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.
† No. 3 pig of this lot (3) having been killed, the results relate to 7 pigs only.
‡ No. 2 pig of this lot (6) having been killed on Feb. 5 and No. 5 pig on Jan. 7, the results relate to 6 pigs only.

TABLE XLVIII.—EXPERIMENTS made with PIGS, at ROTHAMSTED, HERTS.

Summary of the Weights, and of the Increase in Live-weight. **Total Period; December 24, 1863, to March 3, 1864.**

Pigs.	Weights at Commencement Dec. 24, 1863.	Increase (or Loss) in Weight. In 2 Weeks; Dec. 24, 1863, to Jan. 7, 1864.	In 2 Weeks; Jan. 7, to Jan. 21, 1864.	In 2 Weeks; Jan. 21, to Feb. 4, 1864.	In 2 Weeks; Feb. 4, to Feb. 18, 1864.	In 2 Weeks; Feb. 18, to March 3, 1864.	Weights at Conclusion March 3, 1864	Increase in Live-weight. Total in 10 Weeks.	Per Head per Week.	Per 100 lbs. Live-weight per Week.
Lot 1.—8 Pigs: Food—Pea-meal, and Unmalted Barley "No. 1."										
Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
1	139	24	34	24	25	20	267	129	12 14·4	5 12[illegible]
2	160	29	38	32	35	29	338	178	17 9·6	7 1[illegible]
3	133	33	39	28	16	22	264	131	13 1·6	6 9[illegible]
4	134	29	40	22	26	25	287	153	15 4·8	7 4[illegible]
5	135	26	26	29	25	26	270	135	13 8·0	6 10[illegible]
6	129	29	47	30	33	27	297	178	17 8·0	8 5[illegible]
7	129	39	29	21	18	13	241	119	11 14·4	6 9
8	139	38	32	33	29	26	280	139	13 12·8	7 13[illegible]
Totals . . .	1088	274	[illegible]	219	[illegible]	198	2264	1176	—	—
Averages . .	136	34¼	35½	27⅜	26	24¾	283	147	14 11·2	7 0[illegible]
Lot 2.—8 Pigs Food—Pea-meal, and Malted Barley "No. 1" (with Malt-dust).										
Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
1	172	17	35	26	13	28	290	118	11 12·8	5 1[illegible]
2	144	24	30	26	29	26	278	134	13 6·4	6 5[illegible]
3	143	22	20	19	19	11	243	100	10 0·0	5 2[illegible]
4	133	26	26	26	16	−7	240	107	10 11·2	5 11[illegible]
5	130	21	23	16	10	14	224	94	9 6·4	5 5
6	134	16	24	24	18	12	238	104	10 6·4	5 14[illegible]
7	119	22	26	16	16	15	214	95	9 8·0	5 11[illegible]
8	123	17	24	16	9	7	198	75	7 4·8	4 9[illegible]
Totals . . .	1087	165	209	170	126	108	1912	825	—	—
Averages . .	135⅞	20⅝	26⅛	21¼	16	13½	239	103⅛	10 5·0	5 6
Lot 3.—8* Pigs Food—Pea-meal, Unmalted and Malted Barley "No. 1" (with Malt-dust).										
Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
1	147	27	24	23	29	21	280	133	13 4·8	6 3[illegible]
2	150	30	28	30	32	27	287	137	13 11·2	6 4[illegible]
3*	150	18	(−5*)	—	—	—	—	(13*)	—	—
4	144	21	27	26	21	23	268	128	12 12·8	6 7[illegible]
5	130	25	30	26	22	21	273	144	14 6·4	7 9[illegible]
6	120	29	34	29	24	22	280	160	16 0·0	7 8
7	134	34	28	28	25	29	294	160	16 0·0	7 13[illegible]
8	[illegible]	12	[illegible]	21	21	21	281	109	10 4·8	5 11[illegible]

2	147	25	28	28	28	28	262	135	13 8·0	[illegible]
3	148	28	38	37	33	28	306	164	16 6·4	7 0¾
4	140	31	25	25	25	6	263	129	13 3·2	6 1
5	136	30	29	19	23	19	259	123	13 4·8	6 3⅝
6	126	28	30	19	23	19	245	119	11 14·4	6 6⅝
7	133	28	33	28	24	30	280	147	14 11·2	7 2
8	112	28	35	28	28	21	252	140	14 0·9	7 11
Totals . . .	1086	223	274	204	205	167	2159	1073	—	—
Averages . .	134¼	27⅞	34¼	25½	25⅝	20⅞	269⅞	134⅛	13 6·6	6 9¾

Lot 5.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 2" (with Malt-dust).

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
1	156	14	40	24	32	18	284	128	12 12·8	5 13
2	152	30	42	14	25	21	294	142	14 3·2	6 5¾
3	150	25	39	31	28	25	298	148	14 12·8	6 9¾
4	130	17	31	14	25	17	234	104	10 6·4	5 11¼
5	135	26	32	27	22	20	262	127	12 11·2	6 6¼
6	126	38	32	28	26	20	270	144	14 6·4	7 4¼
7	134	6	28	26	23	11	228	94	9 6·4	5 3
8	130	17	33	26	25	21	252	122	12 3·2	6 6½
Totals . . .	1113	173	277	200	206	153	2122	1009	—	—
Averages . .	139⅛	21⅝	34⅝	25	25⁶⁄₈	19⅛	265²⁄₈	126⅛	12 9·7	6 3¼

Lot 6.—8† Pigs; Food—Pea-meal, and Mixture of four-fifths Unmalted and one-fifth Malted Barley "No. 2" (with Malt-dust) *ad lib.*

Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
1	168	38	44	34	31	35	350	182	18 3·2	7 0¼
2†	157	35	49	30	—	—	—	(105†)	—	—
3	133	30	29	20	20	18	250	117	11 11·2	6 1⅛
4	128	35	31	30	21	25	270	142	14 3·2	7 2¼
5†	134	—	—	—	—	—	—	(−†)	—	—
6	136	34	30	22	30	31	283	147	14 11·2	7 0¼
7	128	33	27	24	20	18	250	122	12 3·2	6 7¼
8	112	28	26	38	23	21	238	126	12 9·6	7 3¾
Totals . . .	1096	233	227	188	145	148	1641	836	—	—
Averages . .	137	29⅛	32³⁄₇	26⁶⁄₇	24⅙	24⅔	273³⁄₆	139²⁄₆	13 14·9	6 13¼

* No. 3 pig of this lot (3) was killed Jan. 14, and its weights are only taken into calculation in the total and average results given for the first fortnightly period.

† No. 5 pig of this lot (6) was killed Jan. 7, and No. 2 pig on Feb. 5, and the weights of the former are only taken into calculation during the first, and those of the latter during the first three of the fortnightly periods.

Table XLIX.—Experiments made with PIGS, at Rothamsted, Herts.

Summary of Food consumed, and Increase yielded, during each separate Fortnight, and during the entire Period of Ten Weeks.

Periods.		Food consumed.									Increase in Weight.	
Dates.	Number of Weeks.	Per Head per Week.			Per 100 lbs. Live-weight per Week.			To produce 100 lbs. Increase.			Per Head per Week.	Per 100 lbs. Live-weight per Week.
		Pea Meal.	Unmalted Barley.	Malted Barley (with its dust).	Pea Meal.	Unmalted Barley.	Malted Barley (with its dust).	Pea Meal.	Unmalted Barley.	Malted Barley (with its dust).		
Lot 1.—8 Pigs; Food—Pea-meal, and Unmalted Barley "No. 1."												
1863–4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
Dec. 24 to Jan. 7 .	2	7·0	56·2	. .	4·58	36·79	. .	40·9	329·5	. .	17 2	11 3½
Jan. 7 to Jan. 21 .	2	7·0	62·4	. .	3·73	33·31	. .	39·7	354·6	. .	17 10	9 6½
Jan. 21 to Feb. 4 .	2	7·0	63·1	. .	3·20	28·83	. .	51·1	461·2	. .	13 11	6 4
Feb. 4 to Feb. 18 .	2	7·0	60·3	. .	2·85	24·58	. .	53·8	464·4	. .	13 0	5 4½
Feb. 18 to Mar. 3 .	2	7·0	64·1	. .	2·59	23·69	. .	58·0	531·6	. .	12 1	4 7½
Dec. 24 to Mar. 3 .	10	7·0	61·3	. .	3·35	29·28	. .	47·6	416·8	. .	14 11½	7 0½
Lot 2.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 1" (with Malt-dust).												
1863–4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
Dec. 24 to Jan. 7 .	2	7·0	. .	*56·4	4·75	. .	*37·60	60·5	. .	*479·5	11 9	7 13¾
Jan. 7 to Jan. 21 .	2	7·0	. .	*65·3	4·02	. .	*37·52	46·9	. .	*436·9	14 15	8 9½
Jan. 21 to Feb. 4 .	2	7·0	. .	*60·9	2·51	. .	*30·51	65·9	. .	*572·8	10 10	5 8½
Feb. 4 to Feb. 18 .	2	7·0	. .	*52·1	3·21	. .	*23·88	87·5	. .	*651·0	8 0	3 10½
Feb. 18 to Mar. 3 .	2	7·0	. .	*40·2	3·01	. .	*17·28	108·7	. .	*624·1	6 7	2 12½
Dec. 24 to Mar. 3 .	10	7·0	. .	*54·8	3·70	. .	*29·22	67·9	. .	*531·0	10 5	5 8
Lot 3.—8† Pigs; Food—Pea-meal, Unmalted, and Malted Barley "No. 1" (with Malt-dust).												
1863–4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs. ozs.	lbs. ozs.
Dec. 24 to Jan. 7 .	2	7·0	34·2	*21·6	4·65	22·75	*13·05	55·2	269·7	*165·4	12 11	8 7

1863-4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	ozs.	lbs.	ozs.
Dec. 24 to Jan. 7	2	7·0	50·0	. .	4·68	33·40	. .	50·2	358·7	. .	13	15	9	5
Jan. 7 to Jan. 21	2	7·0	58·6	. .	3·87	32·43	. .	40·9	342·3	. .	17	2	9	7½
Jan. 21 to Feb. 4	2	7·0	55·6	. .	3·32	26·41	. .	54·9	436·3	. .	12	12	6	0¾
Feb. 4 to Feb. 18	2	7·0	57·6	. .	2·96	24·40	. .	54·6	449·8	. .	12	13	5	6¾
Feb. 18 to Mar. 3	2	7·0	61·0	. .	2·70	23·52	. .	67·1	584·7	. .	10	7	4	0¼
Dec. 24 to Mar. 3	10	7·0	56·6	. .	3·45	27·90	. .	52·2	421·9	. .	13	6¼	6	9¾

Lot 5.—8 Pigs; Food—Pea-meal, and Malted Barley "No. 2" (with Malt-dust).

1863-4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	ozs.	lbs.	ozs.
Dec. 24 to Jan. 7	2	7·0	. .	*58·6	4·67	. .	*39·10	64·7	. .	*542·4	10	13	7	3¾
Jan. 7 to Jan. 21	2	7·0	. .	*67·0	3·93	. .	*37·63	40·4	. .	*387·4	17	5	9	11½
Jan. 21 to Feb. 4	2	7·0	. .	*71·0	3·37	. .	*34·18	56·0	. .	*568·4	12	8	6	0
Feb. 4 to Feb. 18	2	7·0	. .	*68·2	3·00	. .	*29·25	54·4	. .	*529·8	12	14	5	8¾
Feb. 18 to Mar. 3	2	7·0	. .	*65·6	2·74	. .	*25·64	73·2	. .	*685·7	9	9	3	11¾
Dec. 24 to Mar. 3	10	7·0	. .	*66·1	3·46	. .	*32·69	55·5	. .	*524·0	12	9¾	6	3¾

Lot 6.—8‡ Pigs; Food—Pea-meal, and Mixture of four-fifths Unmalted, and one-fifth Malted Barley "No. 2" (with Malt-dust).

1863-4.		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	ozs.	lbs.	ozs.
Dec. 24 to Jan. 7	2	7·0	43·8	*10·9	4·62	28·87	*7·22	48·1	300·4	*75·1	14	9	9	9¾
Jan. 7 to Jan. 21	2	7·0	52·7	*13·2	3·74	28·21	*7·05	43·2	325·2	*81·3	16	3¼	8	10¾
Jan. 21 to Feb. 4	2	7·0	52·8	*11·6	3·23	24·36	*6·11	52·1	392·9	*98·5	13	6¾	6	3¾
Feb. 4 to Feb. 18	2	7·0	47·2	*11·8	2·96	19·93	*4·98	57·9	390·4	*97·6	12	1¾	5	1¾
Feb. 18 to Mar. 3	2	7·0	47·7	*11·8	2·68	18·25	*4·53	56·8	386·5	*95·9	13	5¼	4	11¾
Dec. 24 to Mar. 3	10	7·0	48·8	*12·2	3·43	23·95	*5·98	50·2	350·4	*87·5	13	15	6	13¼

* These figures represent, not the actual weights of malt and malt-dust, but the weight of the barley from which they would be produced.
† No. 3 pig of this lot (3) was killed Jan. 14, and its consumption of food and weights are only taken into account in the results given for the first fortnightly period.
‡ No. 5 pig of this lot (6) was killed Jan. 7, and No. 2 pig on Feb. 5, and of the former the consumption of food and weights are only taken into account in the results given for the first, and of the latter only in those given for the first three of the fortnightly periods.

TABLE L.—EXPERIMENTS made with PIGS, at ROTHAMSTED, HERTS.

Weights of the Carcasses, &c.

Designation of Parts.	PIGS.								
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	Means.
Lot 1.—Food—Pea-meal, and Unmalted Barley "No. 1."									
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Carcass (cold)	227	271¼	204	224¼	208	238	199	221½	224⅛
Offal parts, loss by fasting, evaporation, &c.	60	64¾	60	62¾	62	59	42	58½	58⅝
Live-weight (unfasted)	287	336	264	287	270	297	241	280	283¾
Lot 2.—Food—Pea-Meal, and Malted Barley "No. 1" (with Malt-dust).									
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Carcass (cold)	227¼	217¼	188	199	173½	180	160½	157	187⅞
Offal parts, loss by fasting, evaporation, &c.	62¾	60¾	54	41	50½	48	53½	39	51⅛
Live-weight (unfasted)	290	278	242	240	224	228	214	196	239
Lot 3.—Food—Pea-meal, and Unmalted and Malted Barley "No. 1" (with Malt-dust).									
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Carcass (cold)	223½	227	..	231¼	222½	231	229¾	184½	221⅜

	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.		
Carcass (cold)	213¾	255½	236¾	209½	204	196	220½	192	212½
Offal parts, loss by fasting, evaporation, &c.	59¼	56½	69¼	52½	55	49	59½	60	57⅜
Live-weight (unfasted)	273	282	306	262	259	245	280	252	269⅞

Lot 5.—Food—Pea-meal, and Malted Barley "No. 2" (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Carcass (cold)	227¾	229¼	235	180½	205¾	210	177½	189	206¾
Offal parts, loss by fasting, evaporation, &c.	56¼	64¾	63	53½	56¼	60	50½	63	58½
Live-weight (unfasted)	284	294	298	234	262	270	228	252	265¼

Lot 6.—Food—Pea-meal, and Mixture of four-fifths Unmalted and one-fifth Malted Barley "No. 2" (with Malt-dust).

	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Carcass (cold)	281	..	123	213½	..	222	206	189½	217½
Offal parts, loss by fasting, evaporation, &c.	76	..	59	60½	..	74	50	52½	62
Live-weight (unfasted)	357	..	252	274	..	296	256	242	279½

TABLE LI.—EXPERIMENTS made with PIGS, at ROTHAMSTED, HERTS.

Per-centages of the Carcasses, &c., in the Live-weights (unfasted).

Designation of Parts.	PIGS.								
	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	Means.
Lot 1.—Food—Pea-meal, and Unmalted Barley "No. 1."									
Carcass (cold)	79·09	80·73	77·27	78·14	77·04	80·13	82·57	79·11	79·26
Offal parts, loss by fasting, evaporation, &c.	20·91	19·27	22·73	21·86	22·96	19·87	17·43	20·89	20·74
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Lot 2.—Food—Pea-meal, and Malted Barley "No. 1" (with Malt-dust).									
Carcass (cold)	78·36	78·15	77·69	82·92	77·46	78·95	75·00	80·10	78·58
Offal parts, loss by fasting, evaporation, &c.	21·64	21·85	22·31	17·08	22·54	21·05	25·00	19·90	21·42
	100·00	100·00	100·00	100·00	100·00	100·[illegible]	100·00	100·00	100·00
Lot 3.—Food—Pea-meal, and Unmalted and Malted Barley "No. 1" (with Malt-dust).									
Carcass (cold)	76·54	76·17	..	78·21	77·44	78·04	78·06	77·52	77·43
Offal parts, loss by fasting, eva-	23·46	23·83	..	21·79	22·56	21·96	21·94	22·48	22·56

Carcass (cold)	78·30	79·96	77·37	79·87	78·76	80·00	78·66	76·10	78·64
Offal parts, loss by fasting, evaporation, &c.	21·70	20·04	22·63	20·13	21·24	20·00	21·34	23·81	21·36
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Lot 5.—Food—Pea-meal, and Malted Barley "No. 2" (with Malt-dust).

Carcass (cold)	80·19	77·98	78·86	77·14	78·53	77·78	77·85	75·00	77·92
Offal parts, loss by fasting, evaporation, &c.	19·81	22·32	21·14	22·86	21·47	22·22	22·15	25·00	22·08
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

Lot 6.—Food—Pea-meal, and Mixture of four-fifths Unmalted and one-fifth Malted Barley "No. 2" (with Malt-dust).

Carcass (cold)	78·71	..	76·59	77·92	..	75·00	80·47	78·30	77·83
Offal parts, loss by fasting, evaporation, &c.	21·29	..	23·41	22·08	..	25·00	19·53	21·70	22·17
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00

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ON THE

COMPOSITION, VALUE,

AND

UTILIZATION OF TOWN SEWAGE:

BY

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AND

J. H. GILBERT, Ph.D., F.R.S., F.C.S.

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CONTENTS.

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On the Composition, Value, and Utilization of Town Sewage.*

By J. B. LAWES, ESQ., F.R.S., F.C.S., and J. H. GILBERT, Ph.D., F.R.S., F.C.S.

Position of the Sewage Question.

IT is no less true than strange that, after so many centuries of advance in regard to almost every other requirement of civilized life, the lesson should not yet have been learnt of how to dispose of the excretal matters of large populations, in such a manner as to secure both their collection and removal without nuisance and injury to health, and their economical utilization for the reproduction of food. But it is undoubtedly the fact that, hitherto, where utilization has been the most complete, comfort and health have generally been in the greatest degree sacrificed, and where, on the other hand, the refuse matters of town populations have been the most rapidly and perfectly removed from their dwellings, there has been either no utilization at all, or it has been most imperfectly attained.

Sewage, the foul stream which flows through the underground veins and arteries of our great cities, carrying with it the excretal and other refuse matters of large populations, hitherto to little better purpose than to be wasted, and to be a source of pollution to our rivers—to destroy their fish, injure their channels, and

* The substance of this paper was given as a Discourse before the Chemical Society, February 1, 1866, by Dr. Gilbert.

brought us in this country, so far as utilization and the c
of our rivers are concerned, that some authorities, espe
the Continent, incline to the reactionary conclusion that
to the cesspool system, or rather the adoption of some i
barrel, tank, or cesspool system, of collection and remova
admixture with extraneous water is inevitable.

Before, therefore, entering upon the question of the com
value, and modes and results of the utilization of dil
sewage, it will be well to call attention, though very b
some of the results of experience hitherto attained, un
systems of town purification, and other modes of utili
the products, than the modern ones by means of water.

China and Japan are frequently cited as affording exa
very perfect utilization of human excretal matters, and,
sequence, of great productiveness of the soil and great
tration of population on a given area of land. The m
collecting, removing, and transporting human excretal m
those countries is, however, such as to be quite inadmiss
our modern notions of cleanliness, decency, comfort, and

It is frequently stated that in Belgium human excreta
are very perfectly utilized, and realise considerable mone
to the town populations. Indeed, in one of the applicati
only last year to the Metropolitan Board of Works for th
sion of the Southern sewage of the Metropolis, and still u
consideration of that body, it is stated that the excretal
sell in Belgium for something over £1 per person per an

practices adopted are attended with, at any rate, so much of nuisance and discomfort as would not now be permitted in this country; whilst it would appear that a considerable proportion of the urine of the populations escapes collection and utilization. As the result of the same inquiries, it was concluded that, in no case, did the town population realise by the disposal of their excretal matters as much as averaged one franc per head per annum.

The conclusion that, as a rule but little, and frequently nothing, is realised by town populations when their excretal matters are collected under more or less modified cesspool or tank systems, as free as possible from extraneous water, and so removed for application to the land, is fully confirmed by the results of an enquiry conducted by a Commission sent out by the Prussian Government in 1864, to investigate the modes of collection, removal, and utilization, in various localities, with a view to the adoption of improved plans for the city of Berlin.

The Prussian Commissioners, Herren C. v. Salviati, O. Röder, and Dr. Eichhorn, visited and reported upon, not only the Belgium towns of Ghent, Ostend, and Antwerp, but likewise Hanover, Cologne, Metz, Carlsruhe, Strasburg, Basle, Lyons, Zurich, Munich, Nuremberg, Dresden, and Leipzig; and their report shows not only that the householders seldom realised anything like a franc per head per annum for their excretal matters, but that in the majority of cases it cost them something for the removal. Nevertheless, looking to the position and local circumstances of Berlin, and especially to the results of the water-system in this country hitherto, the Commissioners deprecate the adoption of that system for that city, and recommend more perfect arrangements and more stringent regulations for the emptying and removal of the contents of existing cesspools, and, where practicable, the adoption of a system under which the excretal matters of each house are to be collected in a barrel placed at the bottom of the shaft leading from the closets, which, when removed is covered with a closely fitting lid, and is of such dimensions that two men can carry it by means of handles attached for that purpose. They seem to anticipate little, if any, pecuniary profit to the town from these arrangements, but consider that they will be attended with scarcely any, or even no, nuisance or discomfort, and that by their means a large amount of valuable manure will be provided in a convenient form for transport and utilization. There can, however, we think, be little doubt that under such a

system the collection and removal must be attended with cc siderable nuisance, that the greater part of the urine will be lo and that the cost of the collection, removal and transport will such as to render the utilization unprofitable beyond a compa tively limited distance from the city.

There is little probability that the difficulties of the water-syst will lead us in this country to have recourse again in our la towns to any system of cess-pools, tanks, or barrels, howe improved; but it may be well here to notice one or two attem that have been made within the last few years to obviate use of water, and thereby to avoid the pollution of rivers, and secure the collection of the manurial matters in a form m readily transportable by ordinary means, and therefore, more ap cable for general agricultural use: for there cannot be a doubt t if any system could be devised by which human excretal mat could be collected and removed from dwellings, without ei nuisance or injury to health, and obtained economically in a c centrated, dry, and portable condition, their utilization would much more perfectly attained by such means than is at all like or even possible, under the water-system.

Perhaps the most noticeable attempt of the kind in question that which has been made at Hyde, in Lancashire, a manufact ing town of more than 20,000 inhabitants. Some few years a a company contracted to carry out what they call the "Eurel system." They provided boxes to fit in at the back of the pri or closet of nearly every house, leaving scarcely a water-closet the place. Some disinfecting or deodorising mixture is put in the box before it is placed in its position, and the box is exchang for a fresh one after a certain number of days, according to t number of individuals frequenting the place; and it is stipula that neither extraneous water, nor any other than human excre matters, should be accumulated in these receptacles. The box when removed, are covered with closely fitting lids, and so tra ported in closed vans to a manure manufactory close to the to Here the matters are first well mixed, and then strained to rem rags, which are washed and sold for paper-making. More dis fectant is then added, and the matter concentrated by distillati the distilled water being sold to dyers and bleachers. The resi thus thickened is then mixed with coal-ashes, which are collec in the houses in casks left for the purpose, and before being u are re-burnt in a reverberatory furnace, and finely ground.

On visiting Hyde in 1863, it certainly appeared that the mode of collection and preparation adopted was attended with, at any rate, very little unpleasant odour, and it was maintained by the advocates of the system, that its adoption had been successful in a sanitary point of view; though even at that time some difference of opinion existed, and a controversy on the subject was in progress. The system is still in operation; but we are informed that the feeling of the inhabitants is very strong against the maintenance of the works in the neighbourhood; indeed, that an injunction against them has been sought, though unsuccessfully, and that proceedings by indictment are now being taken. This opposition has reference not to the mode of collection, but to the conducting of the manufacture so near to the town. But, whether or not, the plan of collection and removal may have proved successful, so far as the avoidance of nuisance and injury to health are concerned, the process of manufacture seems, unfortunately, to offer but little prospect of successful utilization, so far at least as can be judged from the results of an analysis made at Rothamsted, of a sample of the manure obtained direct from the works. It was found to contain only between 1 and 2 per cent. of ammonia. Such a manure, although it might be useful enough when applied in quantities of many tons to the acre, would obviously be not worth more than its carriage beyond the distance of a very few miles. Besides the great dilution of the more valuable manurial matters by the admixture with ashes, a little consideration of the habits of the people is sufficient to account for the small quantity of ammonia found in the manure; for it is obvious that little of the urine beyond that passed once a day with the fæces would reach the boxes, and so find its way into a manure thus collected and prepared.

One more dry system, the offspring of the difficulties of the wet one, should be briefly noticed, namely, that of the Rev. Mr. Moule. Mr. Moule has invented and patented an arrangement for the use of dry sifted earth, instead of water. He states that by the use of about 4 lbs. per head per day of finely sifted clay, deposited by means of a mechanical arrangement upon the fæcal matters as soon as passed, they are at once entirely deodorised, and in a few weeks are so entirely disintegrated that neither excretal matters nor paper can be detected in the mass, which, he says, looks and smells like fresh earth, and may, after resifting, be re-used, until it has done

duty four times over, by which, of course, there is not only a gre saving of material, but the value of the manure is considerab increased.

Very obvious objections to such a system are—the difficulties the supply and preparation of the soil in the case of towns, or eve in the country in wet seasons; the fact that but little of the urir containing as it does so large a proportion of the valuable manur constituents of human excretal matters, would reach the comp so prepared; and that, in the manure produced, the more valua matters would be diluted with so large a proportion of compa tively useless material, that beyond a very short distance the c of carriage would be all that the manure was worth. On the ot hand, that the adoption of such a system would be a great impr ment in a sanitary point of view, in the cases of sick roo detached houses, or even villages, where the water-system is available, and that it might be even economical where the ea for preparation and absorption, and the land for utilization, are close proximity, may, perhaps, be readily granted. But we are ce tainly not so sanguine as the Rev. Mr. Moule, who seems to thin that with the aid of Earth-closet Companies, his plan is as pra ticable for large towns as is the supply of water, gas, and coal, a present, and much more so than the removal and utilization dilute town sewage.

Whilst it must be admitted that the agricultural utilization human excretal matters has, hitherto, been much more complete attained under the system of collection without water than und our new one with it, it must not be forgotten that neither on t continent of Europe nor in this country has such utilizati resulted in any substantial profit to the towns; and that it is, wi the recorded results of China and Japan before us, and after many centuries of experience nearer home, of at least comparative successful utilization, that the old systems have been abandon as utterly inconsistent with advance in habits and notions cleanliness, and with the maintenance of the comfort and hea of large populations. Nor do the modifications of the dry syster to which brief reference has been made, seem to hold out a hope of general and permanent applicability to large populatio looking, as we must, to the combined requirements of convenien comfort, health, and utilization. Our water-system of hou defecation and town cleansing is, on the other hand, scarcely mo than a generation old. By its means excretal and other refu

rs are more rapidly removed from dwellings than is possible y other; and, independently of the increased comfort and m from nuisance obvious to all, sanitary statistics have antly shown increased immunity from zymotic diseases, and sed longevity, as the result of the adoption of that system. t is that these advantages have, hitherto, been attained at st of the almost universal sacrifice of the manure, and of injury to our rivers.

s, then, is admittedly the existing dilemma of our modern ces. But public attention is now so thoroughly directed to bject, that little fear need be entertained that either the iatic non-utilization of the sewage, or the pollution of our by it, will long be permitted. Least of all is it reasonable discouragement in the fact, that the system which has done ch for some of our town populations in so short a time, l not, at this early stage of its trial, have accomplished all iight be desired, or to conclude that the nuisances and diffi- incident to the old plans, which have remained unremedied gh so many centuries, have much better chance now than rly of being successfully obviated.

uming that there is more likelihood of the general appli- y, success, and permanence of the water, than of any other 1 of urban defecation, it becomes important to consider the sition, the value, and the modes and results of the utiliza- f the product of that system, namely, *dilute town sewage.*

ny plans have been proposed for the separation of the valu- onstituents from sewer-water, and the manufacture of them ry and easily portable manure. But whilst several of these have been successful in separating the whole of the insoluble imentary matter, and even some small portion of the soluble tuents, leaving the fluid to a great extent, or at any rate rarily, purified, and in a much less objectionable condition rning into rivers, none have succeeded in either adequate or nent purification, or in the separation of the more valuable rial matters, and the production of a concentrated solid e-manure, having a sufficient value to be remunerative, and r the cost of transport more than a very few miles;* nor

information in regard to some of the plans proposed for the partial purifi- of sewage-water, or for the separation of a solid manure from it, see—"On plication of Sewage to Agriculture," by Dugald Campbell, Esq., F.C.S., Soc. Qu. J. vol. x., p. 272. "Report of Chemical Investigations relating to

when we consider the great solubility of some of the more active manurial constituents of sewage, and the great dilution of them in the sewage, can any hope be held out of so desirable a consummation;—desirable, indeed, for if human excretal matters, the residue of the constituents consumed as food, cannot be recovered in the form of a concentrated, dry, and easily transportable manure, little hope can be entertained of their re-distribution over anything like the area from which they came, or of their general use for the direct reproduction of the varied descriptions of food which were their source.

The questions arise: What is the amount, and what approximately the money value for the purposes of manure, of the constituents contributed to sewage by a given population? What their state of dilution in sewer-water? To what soils and crops is dilute sewage the most applicable? What is the money-value realisable in practice by sewage utilization? What are the conditions of profit or loss to towns of such utilization?

Composition and Value of Town Sewage.

It is one thing to determine the amount of constituents contained in sewage, or contributed to it by a given population, and to estimate their value accordingly, as if they existed in the dry and portable condition of the various concentrated manures of known value in the market; but it is obviously quite another to settle the really available or realisable value of the same constituents when they are distributed through an enormous volume of water, and if they must be transported and utilized in that condition. Let us first consider what may be called the theoretical value of the constituents of sewage, or their estimated value, taking as the measure the value of the same constituents in dry and portable manures.

Numerous authorities have undertaken the consideration of this question, and two chief methods have been adopted. One of these has been to take samples of sewage and determine its composition by analysis, to adopt such estimates as are at command relating to the amount of sewage available within a given time or

The Metropolitan Main Drainage Question," by A. W. Hofmann, LL.D., F.R.S., and Henry M. Witt, F.C.S., Report on Metropolitan Drainage, 1857. Deodorization of Sewage, Second Report of the Royal Sewage Commission, 1862, Appendix No. 6, p. 64.

rom a given population, and so to reckon the amount and value of the constituents in a given quantity of sewage, or per head, or or a given number of persons, per annum. Another is to base he calculation upon the amounts of fæces and urine, or of the various constituents of these, which have been recorded as voided by individuals of different sexes and ages—sometimes making allowance, and sometimes not doing so, for other than human excretal matters reaching the sewers.

First, as to the results attained when the calculation is based upon the analysis of sewage, and estimates of the amount of it yielded by a given population.

In estimates of the value of the constituents of sewage, about three-fourths of the total value has generally been attributed to the ammonia (or nitrogen reckoned as ammonia); and it so happens that if a value of 8d. be put upon every lb. of ammonia shown by analysis to be contained in sewage, or if for each grain of ammonia per gallon, a value of one farthing be given to the total constituents in 1 ton of the sewage, the result will, in either case, agree almost exactly with that obtained by the elaborate method of giving the currently adopted market values to the several constituents, taking dry and portable manures as the standard.

One or two illustrations may be given of the applicability of the latter mode of reckoning. In the summer of 1863, Baron Liebig, adopting as the basis of his calculations an analysis of the Dorset Square sewage by Mr. Way, which showed nearly 18 grains of ammonia per gallon, estimated that (provided the quantity of phosphates which he considered requisite to render the whole of the ammonia available were employed with the sewage) the constituents in 1 ton of sewage of that composition would be worth about 4d. Now, according to our mode of estimate stated above, 18 grains of ammonia per gallon would indicate a value of 18 farthings, or 4½d., for the total constituents in 1 ton of the sewage. In January, 1865, Baron Liebig assumed the average sewage of the Metropolis to contain only 7·2 (instead of 18) grains of ammonia per gallon; and he estimated the value of the constituents in 1 ton of such sewage to be rather over 1¾d. Our estimate would also give rather over 7 farthings, or 1¾d. Lastly on this point, in 1857, Messrs. Hofmann and Witt concluded from their investigations that the average *dry weather* sewage of the Metropolis contained about 8·2 grains of ammonia per gallon;

and calculating the value of the sewage according to the amount of ammonia, organic matter, phosphoric acid, and potassa, they estimated that of the total constituents in 1 ton of such sewage to be about 2·11d. It is clear that giving a value of ¼d. to the total constituents per ton of sewage, for each grain of ammonia per gallon, would yield almost identically the same result.

It is obvious, therefore, that in this part of the discussion we may, for all practical purposes, safely disregard everything but the amount of ammonia contained in the sewage, and that by so doing the consideration of the subject will be greatly simplified. It will be seen, too, that in adopting this course we do not in any way ignore, or undervalue, the importance of the associated constituents, but, on the contrary, accord to them the same value as Baron Liebig, Messrs. Hofmann and Witt, and others, have done by a much more elaborate process of calculation.

Numerous analyses have been made from time to time of samples of the Metropolitan and other sewage; and sometimes very important theoretical conclusions, and even propositions for the investment of enormous amounts of capital in utilization schemes, and anticipations of enormous profits from their adoption, have been based upon the results of a single analysis. Such, however, is the variation in the dilution of the sewage of any one locality at different times, that it is quite impossible to draw any safe conclusions from the results of analysis without carefully taking into consideration the circumstances affecting the dilution at the time of sampling. This is strikingly illustrated by the results given in Table I., in which are recorded the grains of ammonia per gallon, as determined by various experimenters, in samples of the Metropolitan sewage, taken at different times and places, and also the estimated value of the total constituents in one ton of the sewage, reckoned according to the number of grains of ammonia per gallon as above referred to.

TABLE I.

s of Ammonia per gallon in different samples of Metropolitan Sewage, and estimated value of constituents in one ton.

uthority.	Name of Sewer.	Time of Sampling.	Ammonia per Gallon.	Estimated Value per ton.
			Grains.	d.
....	Barrett's Court	Day	41·28	10¼
	Dorset Square	Day	17·96	4½
	The Fleet	Noon	5·15	1¼
		Midnight	8·50	2
	London Bridge	Noon	6·69	1¾
		Midnight	8·10	2
	Dowgate Dock	Noon	10·03	2½
		Midnight	3·43	0¾
	Iron Gate	Noon	8·13	2
		Midnight	6·20	1½
	Paul's Wharf	Noon	12·01	3
		Midnight	3·13	0¾
	Whitefriar's Dock	Noon	5·35	1¼
		Midnight	3·41	0¾
r	Custom House, West ...	Noon	6·25	1½
		Midnight	8·17	2
	Custom House, East ...	Noon	7·28	1¾
		Midnight	15·01	3¾
	Hambro' Wharf	Noon	7·69	2
		Midnight	5·69	1½
	Wool Quay	Noon	6·95	1¾
		Midnight	5·00	1¼
	Tower Dock	Noon	10·02	2½
		Midnight	7·15	1¾
	Mean	... .	7·24	1¾
nn & Witt......	Savoy Street	24 hours	8·21	$2\frac{1}{10}$

ie results given at the head of the table, on the authority of Way, are those of probably the first analyses made of the ropolitan sewage, and it is only fair to say that at the time he ished them, he expressly stated that although they showed there was great manurial value in sewage, yet they could not aken as in any way affording a measure of that value. It was, ever, upon the analysis of the sample of the Dorset Square ige, showing nearly 18 grains of ammonia per gallon, that Baron ig based his calculations as to the value of the Metropolitan ige in 1863; and the advocates of particular sewage schemes, even members of Parliamentary Committees, have sought to id much upon the results of those analyses.

From the varying circumstances under which the samj analysed by Dr. Letheby were taken, as indicated in the tabl is obvious that the results, though very valuable in that resp must be considered rather as illustrations of the variation composition of the Metropolitan sewage at different times places, and as showing the danger of founding important pract conclusions upon the results of the analysis of an individ sample, than as affording direct evidence as to the aver composition of the Metropolitan sewage.

The sample analysed by Messrs. Hoffmann and Witt wa mixture of equal portions taken every hour during twenty-f hours of dry weather, and there is no doubt that that sample h better claims to be taken as representing the average dry weath sewage of the Metropolis than any other that had up to that ti been collected and examined. It was upon the analysis of tl sample that Messrs. Hofmann and Witt, calculating the val of the ammonia, organic matter, phosphoric acid, and potas which it contained, estimated that the constituents in one ton such dry weather sewage would be worth rather over 2d., ar according to the information supplied to them for the purpose their calculations, the quantity of sewage, exclusive of rainfa would be about 158,000,000 tons per annum, or scarcely thr fifths as much as that assumed in the estimates of Baron Liel and Mr. Thomas Ellis, as the total sewage, namely, 266,000,0 tons. Yet, Messrs. Hofmann and Witt's estimate of a little o 2d. for the value of the constituents in one ton of the normal d weather sewage was taken by Mr. Ellis, in his application for t concession of the Metropolitan sewage, as applying to the wh amount of dilute sewage (inclusive of rainfall and subsoil wat which he estimated would be available for utilization (266,000,0 tons), and his calculations of profit to his Company and to t ratepayers were based upon this erroneous assumption.

To conclude in reference to the results recorded in Table attention may be called to the fact that the different samples sh a variation of from about 3 to more than 41 grains of ammo per gallon, representing approximately a difference of from ab ¾d. to about 10¼d. for the estimated value of the total constitue in one ton of the sewage.

That the results of an analysis of a sample of sewage of a locality taken without careful reference to the circumstances of dilution, are not only entirely inadequate as the basis of gene

conclusions, but may even be utterly misleading, is even more strikingly illustrated by the results next to be considered, which were obtained in the course of an investigation undertaken by the late Royal Sewage Commission.

Three members of the Commission, the late Mr. Henry Austin, C.E., Mr. Way, and one of the authors (J. B. Lawes) were appointed a sub-committee to undertake an investigation on the utilization of sewage. The agricultural experiments were conducted at Rugby, and their management, and the selection, collection, and preparation of samples for analysis, devolved upon the authors, the analyses being made in the laboratory of Mr. Way. The inquiry extended over a period of between three and four years, and involved the application of different quantities of sewage to meadow-grass and some other crops; the determination of the amounts of produce obtained; the feeding of fattening oxen and milking cows on the unsewaged and the sewaged grass; and the sampling, and more or less complete analysis, of the soil, of the sewage, of the drainage-water from the irrigated land, of the unsewaged and the sewaged grass, of the milk yielded by the cows fed upon it, &c., &c. It is proposed to embody in the sequel a brief abstract statement of some of the more important facts and conclusions brought out by the experimental inquiry above referred to, and the reader is referred for all fuller details to the Reports of the Commission.*

The mode of collecting samples of the Rugby sewage for analysis was, to take about a quart (from a gauge-tank holding between 3 and 4 tons, through which the sewage flowed before passing on to the land), at intervals of about two hours for several days together, well mix the quantity so accumulated, and take a sample of the mixture for analysis. 93 such mixed samples were collected and analysed, the period of collection extending over 31 months, from April, 1861, to October, 1863, inclusive. Table II. shows the highest, the lowest, and the average amounts of ammonia, and total solid matter, which the analyses of these numerous mixed samples indicated.

*Second Report of the Commission appointed to inquire into the best mode of Distributing the sewage of Towns, and applying it to beneficial and profitable uses; 1862. Third do. do., 1865.

Table II.

Showing the highest, lowest, and average amounts of Ammonia, and total Solid Matter, in mixed samples of Rugby Sewage at different times.

		Ammonia.		Total Solid Matter.	
		Grains per Gallon.	lbs. per 1000 Tons.	Grains per Gallon.	lbs. per 1000 Tons.
1861	Highest	15·64	500·5	216·5	6928
	Lowest	2·99	95·7	37·6	1203
	Mean of 24 analyses	6·39	204·5	75·1	2405
1861-2	Highest	11·38	364·2	129·3	4138
	Lowest	2·55	81·6	50·5	1616
	Mean of 34 analyses	5·95	190·4	80·3	2570
1862-3	Highest	12·81	409·9	269·9	8637
	Lowest	3·14	100·5	62·2	1989
	Mean of 35 analyses	7·08	226·5	103·2	3302

Thus, although each sample analysed was a mixture of samples taken over several days together, as above described, there was a variation among the 93 samples of from 2½ to 15½ grains of ammonia, and from 37½ to 270 grains of total solid matter, per gallon; or, of from 81½ to 500½ lbs. of ammonia, and from 1203 to 8,637 lbs. of total solid matter, per 1,000 tons of sewage. Reckoned according to the number of grains of ammonia per gallon, the estimated value of the total constituents in 1 ton of sewage varied from about ⅝d. to nearly 4d.

Notwithstanding the very great differences in the composition of the Rugby sewage at different times, much greater, indeed, than could have been expected, considering the circumstances of the sampling, it is still believed that the mean of so many determinations may be taken as indicating, at any rate approximately, the average composition of the Rugby sewage over the period to which they refer. The probability of this will be seen on a consideration of the average results for each of the three seasons, and for the total period of 31 months of collection, given in Table III.

Table III.

Mean Composition of Rugby Sewage, in 1861, 1862, *and* 1863.

Constituents.		Means of: 24 Samples April to Oct 1861.	34 Samples Nov. 1861 to Oct. 1862.	35 Samples Nov. 1862 to Oct. 1863.	93 Samples April 1861 to Oct. 1863.
		Grains per gallon.			
ı suspension	Inorganic	14·36	20·86	34·45	24·30
	Organic	14·16	16·84	24·03	18·85
	Total	28·52	37·70	58·48	43·15
solution	Inorganic	36·34	34·42	36·80	35·81
	Organic	10·28	8·20	7·92	8·63
	Total	46·62	42·62	44·72	44·44
	Total inorganic ...	50·70	55·28	71·25	60·11
	Total organic	24·44	25·04	31·95	27·48
	Total solid matter .	75·14	80·32	103·20	87·59
mmonia	In suspension.........	1·41	1·47	1 86	1·60
	In solution	4·98	4·48	5·22	4·89
	Total	6·39	5·95	7·08	6·49
		lbs. per 1000 tons.			
n suspension	Inorganic	460	668	1102	778
	Organic	453	539	769	603
	Total	913	1207	1871	1381
n solution	Inorganic	1163	1101	1178	1146
	Organic	329	262	253	276
	Total	1492	1363	1431	1422
	Total inorganic ...	1623	1769	2280	1924
	Total organic	782	801	1022	879
	Total solid matter .	2405	2570	3302	2803
Ammonia	In suspension	45	47	60	51
	In solution...........	159	143	167	157
	Total	204	190	227	208

It is seen that the mean result of the analyses of 24 samples collected from April to October, inclusive, 1861, indicates 6·39 grains of ammonia per gallon; that of 34 samples collected from November 1861, to October 1862, inclusive, 5·95 grains, and that of 35 samples, collected from November 1862, to October 1863, inclusive, 7·08 grains. This difference in the average concentration of the sewage of the different seasons is perfectly consistent with the difference in the character of the seasons themselves. Thus, the season of 1861-2 was much the wettest, and its sewage was, accordingly, the most dilute; the season of 1862-3 was much the driest, indeed extremely dry, and its sewage was the strongest; and the season of 1861 being intermediate in this respect, its sewage was of intermediate strength.

Looking to the average result of the 93 analyses, it will be observed that the sewage contained about 87½ grains per gallon of total solid matter, of which about two-thirds was inorganic, and one-third organic. About half of the total solid matter was in suspension, and half in solution: of the half in suspension about four-sevenths was inorganic and three-sevenths organic, and of the half in solution, about four-fifths inorganic, and one-fifth organic. Lastly, of the nitrogen reckoned as ammonia, about one-fourth was in suspension, and three-fourths in solution.

The mean of the 93 analyses shows about 6½ grains of ammonia per gallon, indicating a value of about 1⅝d for the total constituents in 1 ton of the sewage. But taking into consideration the fact that the samples were not collected at exactly equal intervals throughout the total period, it is concluded that, by taking the mean result for each of the 31 months separately, and then the mean of the 31 means so obtained, the result will more nearly represent the real average composition of the sewage of the whole period, than will the direct mean of the 93 analyses; and the calculated average so obtained indicates about 7, instead of only 6½, grains of ammonia per gallon.

From all the information at command as to the population contributing to the sewers, the water-supply, the rainfall, and the drainage area, it was concluded that, taking the average of seasons, there are about 60 tons of sewage per head of the population of Rugby, per annum; but that, as the period of the experiments was drier than usual, the amount probably then reached to only about 55 or 56 tons.

Now, if we reckon 6½ grains of ammonia per gallon, and 60

tons of sewage per head per annum, it would result that 12½ lbs. of ammonia were contributed annually for each average individual of the mixed population, of both sexes and all ages; or, if we reckon 7 grains of ammonia per gallon, and 56 tons of sewage per head per annum, we equally arrive at the amount of 12½ lbs. of ammonia per head per annum; and from a careful consideration of the Rugby results, it was concluded, at the time the Report was issued, that this probably very nearly represented the actual truth.

Having, then, by means of the results of a great many analyses of sewage, and a consideration of the amount of sewage obtained for each average individual of the population, estimated that for each average individual there would be about 12½ lbs. of ammonia annually contributed to the sewer-water, let us next see what

TABLE IV.

Amount of Nitrogen reckoned as Ammonia, and estimated value of total Constituents, in Human Voidings, per head per annum.

	Ammonia	Value of Total Constituents.
Adult Males; Hofmann and Witt.		
	lbs.	s. d.
Urine	15·8	10 0½
Fæces	2·3	1 8¾
Total	18·1	11 9¼
Adult Males; Thudichum.		
Urine	15·9	10 3½
Average, both sexes and all ages; Hofmann, Witt, and Thudichum.		
Urine	11·32	7 3
Fæces	1·64	1 2¾
Total	12·96	8 5¾
Average; both sexes and all ages; Lawes and Gilbert.		
According to Food	12·2	8 4
According to Voidings	12·6	
According to Voidings	12·7	
Mean	12·5	

Witt took the amount of urine estimated to be daily voi
adult, and the amount of fæces recorded as voided on tl
per head of the body-guard of the Grand Duke
Darmstadt (but allowing, as they said, a little more f
Bull"), and applying the results of Berzelius' analysis
and those of the analysis of Way, Liebig, and Wesarg,
they calculated the amount of ammonia, and other cor
daily voided by such persons. According to their data, tl
of ammonia annually voided by an adult male was, in u
in fæces 2·8, total 18·1 lbs.; and the estimated money va
constituents was in urine 10s. 0½d., in fæces 1s. 8
11s. 9¼d. The result so obtained for adult males the
applicable to each individual of a mixed population, of l
and all ages, assuming that other matters reaching t
would probably make up the difference. There can be li
that this was making far too liberal an allowance for o
human excretal matters contributing to the value of th

Some years later, in 1863, Dr. Thudichum, from m
comprehensive data, gave for the urine alone of an a
15·9 lbs. of ammonia, and 10s. 3½d. of value; amounts
will be seen, are almost identical with those of Messrs.
and Witt.

But Dr. Thudichum, instead of directly applying tl
obtained for an adult male to each average individual c
population, considered that two adult males would appr

sexes and all ages. By this process, as the Table shows, we have nearly 13 lbs. of ammonia, and nearly 8s. 6d. of value, to represent the mixed voidings of such an average individual.

In 1854, the authors, basing their estimates on very comprehensive data, relating both to the amounts of constituents consumed in the food, and voided in the urine and fæces, of persons of different ages and both sexes, concluded that probably about [illegible] lbs. of ammonia, and total constituents of the estimated manurial value of about 6s. 8d., were annually contributed to sewage per individual of a mixed town population. More recently, for the purposes of the Report of the Royal Sewage Commission, all the estimates relating to the constituents voided were carefully revised, bringing into the calculations such further information as was then at command; * and the results so obtained are recorded in the Table (IV).

The amount of nitrogen estimated to be annually consumed in the food of an average individual was deduced from the calculation of 86 dietaries, arranged in 15 classes, according to sex, age, activity of mode of life, and other circumstances, and corresponded to about 12·2 lbs. of ammonia; from which, of course, a deduction has to be made for the nitrogen retained in the body, and for loss in various ways. When the calculation was based upon determinations or computations of the amounts of nitrogen or ammonia-yielding matters voided by persons of different sexes and ages, the result arrived at was 12·6 lbs. of ammonia; and when upon the recorded amounts of fresh urine and fæces voided, and the average composition of these, the amount indicated was 12·7 lbs. of ammonia per head per annum. A careful consideration, however, of the circumstances of the majority of the cases contributing to the averages among those divisions of the population in relation to which the evidence is the most plentiful, and of the relative character of the results where it is the most deficient, led to the conclusion that the estimate of 12·6, or 12·7 lbs. for the amount

* For nearly the whole, if not the whole, of the data upon which the new estimates are based, *see* "On the Sewage of London," by J. B. Lawes, F.R.S., Journal of the Society of Arts, March 9, 1855; "The Composition of the Urine in Health and Disease," by E. A. Parkes, M.D., 1860; "On an Improved Mode of collecting Excrementitious Matter, with a view to its Application to the benefit of Agriculture, &c.," by J. L. W. Thudichum, M.D., F.C.S., Journal of the Society of Arts, May 15, 1863; and "On the Elimination of Urea and Urinary Water, in relation to the period of the Day, Season, Exertion, Food, &c., &c.," by Edward Smith, M.D., LL.B., F.R.S., Philosophical Transactions, vol. cli, p. 747.

of ammonia voided annually by an average individual of a mixed population, was in all probability too high.

Reviewing the whole of the evidence, both that relating to the composition and the amount of the Rugby sewage, and that relating to the amount of constituents voided by an average individual, it was concluded that the amount of ammonia annually contributed to the sewer-water by an average person of a mixed population was pretty certainly more than 10 lbs., as formerly assumed, but probably less than 12 lbs.; and, making allowance for the fractional part of the excretal matters of horses, cows, dogs, and other animals, of the refuse of slaughter-houses, of soot, and of other refuse matters that may reach the sewers, it was concluded that still not more than 12½ lbs. of ammonia would be contributed annually to the sewers from all sources, per head of mixed town population. This would indicate an estimated value of 8s. 4d. per annum for the total constituents in the sewage for each average individual.

It was admitted, however, to be a great desideratum, that when the Main Drainage of the Metropolis came to be completed, and the works to be in full operation, competent persons should be appointed to superintend the gauging, sampling, and analysis of the sewage, with a view to providing data which might serve to determine satisfactorily and conclusively the approximate amount, and average composition, of the Metropolitan sewage, as it will have to be dealt with in any plan of utilization, and also the relation of population to the composition of sewage generally.

Since the publication of the report of the commission, in March 1865, numerous gaugings and samplings of the sewage of the mid- and high-level sewers North of the Thames have been undertaken, and many samples have been analysed by Mr. Way and Dr. Odling. The results of this inquiry have not yet been published; but from information kindly communicated by Mr. Way, we are enabled to state their general bearing, so far, upon the point now under consideration.

From these new results it appears very probable that the amount of dry weather sewage averages only about two-thirds as much per head of the population as that generally supposed before, and assumed both in the inquiries of Messrs. Hofmann and Witt, and in the Report of the Sewage Commission; but the average amount of ammonia per gallon now found by Mr. Way in the dry weather sewage very nearly approaches that arrived at by

ssrs. Hofmann and Witt. Both Mr. Way and Mr. Cresy ıkly admit, however, in accordance with common experience further a subject is investigated, that there are still many n questions, the settlement of which may materially affect the ɔer interpretation of the new gaugings.

ssuming them to indicate the result at present supposed, and ve stated, it follows that the total amount of ammonia yielded ı given population will be only about two-thirds as much as ; estimated by Messrs. Hofmann and Witt, on applying the ılts of their analysis to the higher estimated amount of the weather sewage. It further follows, from the same evidence, ; the amount of ammonia annually contributed to the sewage, ı all sources, per head of a mixed population, is more nearly bs., as formerly concluded by the authors, than 12½ lbs., as e recently estimated; and if this result should be confirmed, r former estimate of 6s. 8d. will more nearly represent the ılated annual value of the total constituents yielded per head ıe population than the more recent one of 8s. 4d. It would . have to be concluded, as indeed is not improbably the case, , in the calculations based on the mean composition and the nated total amount of the Rugby sewage, the latter had been n at too high a figure, too large a proportion of the rainfall ng been assumed to reach the sewers; and that, in the nates founded on the recorded amounts of constituents ed, the incompleteness of the records, as already pointed out, as was supposed, led to too high an estimate.

'e have, then, from 10 to 12½ lbs. of ammonia, and an estiəd value of from 6s. 8d. to 8s. 4d. for the total manurial conıents, contributed to sewage by each average individual of a əd town population. Adopting these amounts, the questions ə—What will be the amount of ammonia, and what the estiəd value of the constituents, in a given amount of sewage, at rent dilutions? These points are illustrated in Table V.

TABLE V.

Ammonia per gallon, and estimated value of total Constituents in one ton of Sewage at different dilutions.

Dilutions supposed.		If 12½ lbs. Ammonia, per head per annum, from all sources.		If 10 lbs. Ammonia, per head per annum, from all sources.	
Per head per annum.	Per head per day.	Ammonia per gallon.	Estimated value per ton.	Ammonia per gallon.	Estimated value per ton.
Tons.	Gallons.	Grains.	Pence.	Grains.	Pence.
40	24½	9·77	2·44	7·81	2·00
50	30¾	7·81	1·95	6·25	1·60
60	36¾	6·51	1·67	5·21	1·33
70	43	5·58	1·43	4·46	1·14
80	49	4·88	1·25	3·91	1·00
90	55¼	4·34	1·11	3·47	0·89
100	61¼	3·91	1·00	3·13	0·80
200	122½	1·95	0·50	1·56	0·40

According to the information supplied to Messrs. Hofmann and Witt, the dry weather sewage of the Metropolis amounted to between 36 and 37 gallons per head per day = about 60 tons per head per annum. Their analysis showed 8·2 grains of ammonia per gallon, equivalent to about 15¾ lbs. of ammonia per head per annum; and they reckoned the total constituents in 1 ton of such sewage to be worth 2·11d. But Table V shows that with a dilution of 60 tons, and with 12½ lbs. of ammonia per head per annum, there would be only 6·5 grains of ammonia per gallon, and total constituents in 1 ton of sewage worth only 1⅔d.; and that with only 10 lbs. of ammonia per head per annum, there would be only 5·2 grains per gallon, and constituents worth only 1⅓d. in 1 ton of the sewage.

If, however, we take the dry weather sewage as indicated by the recent gaugings as more nearly 24 gallons per head per day = a rate of 40 tons per head per annum, we have then, with 12½ lbs. of ammonia per head per annum, 9·77 grains per gallon, and 2·44d. worth of constituents per ton; or, taking 10 lbs. of ammonia per head per annum, we have 7·8 grains per gallon, and constituents in 1 ton of an estimated value of nearly 2d. Now, Mr. Way's conclusion is, that the mid- and high-level dry weather sewage North of the Thames averages scarcely, but nearly, 8 grains of

mmonia per gallon, or almost exactly the amount last mentioned; nd as Messrs. Hofmann and Witt's analysis shows 8·2 grains, will be seen that both estimates, taken in connection with the nended one as to the daily amount per head of the dry weather wage, go to confirm the assumption that the amount of ammonia ntributed to the sewage from all sources is much more nearly) than 12½ lbs. per head per annum.

Whatever may eventually prove to be the average dilution of e dry weather Metropolitan sewage, the actual amount of fluid aries immensely from time to time, according to rainfall and ther circumstances. When it exceeds a certain amount, as in e case of continuous rains or storms, a portion will pass at once to the Thames; and according to Mr. Bazalgette's figures it ppears that this will happen when the volume is such as, if connuous, would represent something over 200 tons of fluid per ead per annum. But, so far as information at present at comand enables us to judge, it is probable that the amount, incluive of rainfall and subsoil water, that will be available for tilization, will be somewhere about 80, and will pretty certainly ot exceed 100 tons per head per annum; that is, about twice, or ot more than twice and a half, as much as the most recently stimated dry weather flow. Of course, to result in anything ike such averages, the dilution would sometimes be at a rate very nuch greater than those amounts would indicate. But it may be bserved, by way of illustration, that with 12½ lbs. of ammonia er head per annum, and an average of 80 tons of sewage, it ould average less than 5 grains of ammonia per gallon, and only ·25d. worth of constituents in 1 ton; or, reckoning an average lilution of 100 tons, it would average less than 4 grains of amnonia per gallon, and only 1d. of value of constituents in 1 ton. n like manner, reckoning only 10 lbs. of ammonia per head per nnum, a dilution of 80 tons would show less than 4 grains, and f 100 tons little over 3 grains of ammonia per gallon, and an mount of constituents in 1 ton worth only 1d. and 0·8d. respecively.

In comparison with the figures just given, it may be stated that oth Baron Liebig, and Mr. Thomas Ellis (one of the appliants for the concession of the Metropolitan sewage) assume its otal amount at 266,000,000 tons per annum, which, with ,000,000 population, represents nearly 90 tons per head per nnum; and with this dilution, the former estimates the sewage

to contain an average of 7·2, and the latter 8·2 grains of ammon per gallon; the latter, as already stated, applying the estimate Messrs. Hofmann and Witt for the dry weather sewage to t total estimated amount of available sewage, inclusive of rainf

It is sufficiently obvious that, however variable, the dilution the constituents in town sewage is at any rate very great, a that in any scheme for the utilization of sewage large quantit will have to be dealt with. It will be useful, therefore, by way illustration, and as a means of conveying a more definite idea the extent of this dilution, to show the relation of a given amoun —say 1,000 tons—of sewage of certain assumed dilutions, both t population, and to some well-known portable manure, such a Peruvian guano. This is done in Table VI, which shows th amount of guano which would supply as much nitrogen reckone as ammonia as 1,000 tons of sewage of different dilutions, al the number of tons of sewage which would be equal in th respect to 1 ton of guano, and both on the alternative assum tions of 12½ lbs., and 10 lbs., of ammonia per head per annum. T assumed dilutions are 40, 50, and 60 tons per head per annu which may be taken to cover the minimum and maximum es mated rates of flow for the dry weather sewage of the Metropol 80 and 100 tons, which may be taken to represent the range for t average total available sewage, inclusive of rainfall and subs water, and 200 tons, the probable frequent dilution in wet weath

TABLE VI.

Relation of Sewage to Peruvian Guano in amount of Nitrogen reckoned as Ammonia.

If Sewage per head per annum.	Contributing 1,000 tons Sewage.	If 12½ lbs. Ammonia, per head per annum, from all sources.		If 10 lbs. Ammonia, per head per annum, from all sources.	
		1,000 tons Sewage = Guano.	1 ton Guano = Sewage	1,000 tons Sewage = Guano.	1 ton Guano = Sewag
Tons.	Persons.	Cwts.	Tons.	Cwts.	Tons.
40	25	16⅓	1220	13	1525
50	20	13	1525	10½	1900
60	16⅔	11	1830	8¾	2290
80	12½	8⅕	2440	6½	3050
100	10	6½	3050	5¼	3810
200	5	3¼	6100	2⅝	7620
1 Person = Guano.		⅔ cwt.		½ cwt.	

Thus, with 12½ lbs. of ammonia, and the minimum estimated dilution of the dry weather sewage at a rate of 40 tons per head per annum, 1,000 tons of such sewage would only contain nitrogen, reckoned as ammonia, equal to that in about 16⅔ cwts. of Peruvian guano, or to that in only 13 cwts. if the amount of ammonia per head per annum be reckoned at only 10 lbs. In other words, in the former case it would require 1,220 and in the latter 1,525 tons of sewage to supply the ammonia (or nitrogen reckoned as ammonia) of 1 ton of guano. In like manner, taking 80 tons of sewage per head per annum as a minimum estimate for the average sewage, inclusive of rainfall, with 12½ lbs. of ammonia per head per annum, 1,000 tons would represent the nitrogen of 8¼ cwts., and with 10 lbs., 6½ cwts., of Peruvian guano; or reckoning 12½ lbs. of ammonia per head per annum, 1 ton of Peruvian guano would represent 2,440 tons, and reckoning 10 lbs., it would represent 3,050 tons.

The table also shows that reckoning 12½ lbs. of ammonia per head per annum, the sewage of an average individual would annually represent in nitrogen ⅔ cwt., or reckoning only 10 lbs. per head per annum only ½ cwt., Peruvian guano, per head per annum.

Crops to which Sewage is most applicable.

Hitherto, on grounds shown to be fully justified, we have, for simplicity of illustration, confined attention to the amount of nitrogen or ammonia in sewage, as the measure or indication of its composition, and of the theoretical manurial value of its total solid constituents. It is, however, obviously of interest to consider whether or not the mineral or incombustible constituents of sewage exist in it in sufficient proportion to the ammonia or nitrogen, for the requirements of the crops to be grown; and, as the phosphoric acid and potassa (the one or the other, or both, according to circumstances) are, perhaps, the mineral constituents most likely to be deficient relatively to the nitrogen, their proportion to the latter in sewage, and in various crops, may appropriately be referred to in illustration of the point. Table VII shows the proportion of phosphoric acid and potassa to 100 of nitrogen in sewage, according to the mean of ten analyses of the Rugby sewage, in which the phosphoric acid and the potassa as well as the ammonia were determined. It also shows what

may be taken as approximately representing the average prop- tion of phosphoric acid and potassa to nitrogen in various cro

TABLE VII.

Amount of Phosphoric Acid and Potassa to 100 Nitrogen, in Sewage and in ri crops.

	Phosphoric Acid.			Potassa.		
Rugby Sewage.........	27			42		
	In Corn, Roots, &c	In Straw, Leaves, &c.	In Total Produce.	In Corn, Roots, &c	In Straw, Leaves, &c.	In Total Produce.
Meadow-Hay............	...	...	27*	...	...	100
Clover-Hay	...	...	23	...	...	52
Wheat.....................	48	42	46	28	108	57
Barley.....................	40	34	38	34	126	60
Oats......................	28	37	30	25	155	65
Beans	25	46	30	32	123	50
Mangolds	17	...	...	100	...	...
Swedes	27	16	21	82	44	63
Common Turnips......	28	18	26	160	71	117
Potatoes..................	42	...	...	123	...	...

It is obvious that since the phosphoric acid of sewage like th nitrogen, will be derived almost exclusively from excretal matte and food-refuse, its proportion to the nitrogen will, within co paratively narrow limits, be tolerably uniform; the amount potassa on the other hand, will vary very much according locality, and be considerably greater where the streets or roa are constructed of potassic minerals than elsewhere.

The table shows that, according to the analyses referred t the Rugby sewage contained 27 parts of phosphoric acid a 42 parts of potassa, for 100 of nitrogen. It also shows th on the average, meadow hay contains almost exactly the sa proportion of phosphoric acid to nitrogen as the sewage, but much greater proportion of potassa than the latter.

In the cereal grains the proportion of phosphoric acid

* According to Baron Liebig's estimates, hay contains 51 parts of phosph acid to 100 of nitrogen; but having collated and averaged the results of num independent observers, we can see nothing to lead to the adoption of such a fig whilst direct determinations in a number of samples of each, showed in the Ru sewaged grass 25, and in the unsewaged 32 parts.

ɜn is, on the other hand, higher than in the sewage; in most of the other crops enumerated it is much about ıme. Of potassa, the proportion is lower in the cereal (the only part of the crop which is, as a rule, sold off ıd) than in the sewage, though in the other crops it is lly higher.

there are various circumstances, the adequate discussion ch would occupy more space than it would be appropriate ɔte to their consideration here, which render it quite in-ible to draw direct practical conclusions as to the applica-ɪf sewage to different crops from what may appear, at first ;he obvious indications of the figures in the table. Never-, a careful consideration of the subject leads to the conclu-.at, if sewage alone were applied constantly to meadow land, ı would be more likely to become deficient than phosphoric ıut that, if it were applied to the ordinary crops of rotation, ıoric acid would be more likely to become deficient than ı. Still, granting it to be clearly shown that with this or ɜscription of soil or management, town-sewage was, in pro-ı to its nitrogen, deficient in this or that constituent for the tion of this or that crop, or crops generally, it would by no follow that it was an inappropriate manure on that account; y defect in composition, whether in regard to phosphoric ·otassa, or any other constituent, could be easily compen-'rom other sources.

ıed, independently of what we know of the sources of the ıuents of sewage, and can judge therefrom of their appro-ıess as manure for different crops, there is nothing in the of the analysis of the solid matter of sewage, from which ıuld be justified in concluding that it is not applicable as e to crops generally. On the contrary, a dry and portable e, having the composition of the solid matter of town-ı, would undoubtedly be generally applicable both to corn her rotation crops, and to grass; and its constituents could airly be valued by the same scale as other concentrated 'es in the market.

the great dilution of town sewage, its large daily supply at sons, and its greater amount in wet weather when the land ıst bear, or least requires, more water, render it extremely 'opriate for application on a comprehensive scale to arable for the growth of corn and other ordinary rotation crops.

But, apart from these difficulties, if sewage can only be distrib in small quantities over large areas, at such a cost to the farm has yet been proposed, it is indeed vain to hope that any l proportion of the manurial constituents, derived from the sumption of human food in our towns, can be redistributed the area from which they came; for such is the limit set climate to the amount of manure and of water applicable for c that have to ripen their seed, that, for corn more especially, comparatively small quantities per acre could be employed, hence, were sewage systematically applied for their growth, area of utilization must necessarily be very large. On this p it may be stated that Mr. Rawlinson, one of the members of Royal Sewage Commission, has given it as his opinion that would cost more to distribute 500 tons of sewage per acre, means of pipes, hydrants, and hose and jet, as would be requi in the case of application to arable land and crops generally, t to apply 5,000 tons per acre by means of open runs, as in the c of its application to grass.

From these considerations it will be obvious, that that wh may be called the theoretical value of sewage, reckoned accord to the constituents it contains, is not necessarily its practica available value when used in its highly diluted condition. It be also obvious, that in that condition it is the most appropr for grass, for which it can be employed at all seasons, and in c paratively large quantities on a limited area, and that it is least appropriate for crops which have to ripen. The ques arises—what is the practical or realizable value of the constitu of sewage when they are utilized in the condition of dilutio which they exist in that fluid? This point will be illustrate reference, both to the results of direct experiments, and to experience of practical men who have utilized sewage with a to profit.

Results of direct Experiment on the Utilization of Sewage.

At Rugby two fields of meadow land were experimented u in each one plot was left without sewage, one received sewag the rate of 3,000 tons, one at the rate of 6,000 tons, and o the rate of 9,000 tons, per acre per annum. The experim were so conducted through three consecutive seasons, Table VIII summarizes the results obtained.

Table VIII.

ies of Sewage applied, and of Green Grass obtained, per acre per annum, in Experiments made at Rugby.

Seasons 1861, 1862, *and* 1863.

ns.	Plot 1. Unsewaged.				Plot 2. 3,000 Tons Sewage.				Plot 3. 6,000 Tons Sewage.				Plot 4. 9,000 Tons Sewage.			
	Grass obtained. Five-Acre Field.															
	Tons.	cwts.	qrs.	lbs.	Tons.	cwts.	qrs.	lbs.	Tons.	cwts.	qrs.	lbs.	Tons.	cwts.	qrs.	lbs.
1	9	5	3	5	14	16	3	8	27	1	0	10	32	16	3	8
2	8	3	1	10	27	18	0	18	34	10	0	19	32	9	2	22
3	4	18	3	13	22	5	0	11	34	18	1	27	37	0	2	5
......	7	9	1	9	21	13	1	12	32	3	1	0	34	2	1	12
	Ten-Acre Field.															
1	8	18	0	15	15	16	3	2	22	15	2	12	26	13	3	12
2	16	10	0	25	27	11	0	20	32	2	1	14	31	12	1	20
3	8	0	3	19	25	5	1	8	30	11	2	12	34	19	1	21
......	11	3	0	10	22	17	3	1	28	9	3	13	31	1	3	18
	Averages :—the three years and both Fields.															
and 3	9	6	0	24	22	5	2	7	30	6	2	6	32	12	0	15

e five-acre field was much flatter than the other; its soil and il were much more porous; the mechanical and chemical ination of samples, taken to the depth of 9 inches, showed il to be much more stony, to retain much less water under external conditions, to contain much less organic matter, less nitrogen, much less clay, and much more sand, than that e ten-acre field. It was, in fact, considerably inferior in al quality, and yielded, accordingly, considerably less produce out manure. Notwithstanding this, it will be seen that it upon the whole more total produce per acre under the ence of sewage than did the naturally better soil of the ten-field; and, it will be shown further on, that the sewage was s case both more completely utilized and more completely ied.

It would be inappropriate to discuss in detail here the influence of season and other circumstances upon the produce of the different years or the respective plots. It will be sufficient to call attention to the general character of the results, and to the practical conclusions to which they seem to lead. By the application of sewage a supply of green food was obtained much earlier and much later in the season, and the total quantity per acre was increased several fold. There was, generally, though not invariably, the more produce the greater the amount of sewage applied, the exceptions being in the wet and cold season of 1862. In the other seasons, and in both fields, there was an increase of produce with each increase in the amount of sewage applied; and the largest amounts of produce obtained at all were, in both fields, in the third season of application, and on the plots which had received the largest amounts of sewage. Still, it is important to remark, that the amounts of increase of produce for a given amount of sewage applied were the less where the larger quantities were employed. Experience abundantly shows, indeed, that if the only object were to get the largest possible amounts of produce per acre, as much as 30,000, 40,000, or even 50,000 tons of sewage might frequently be applied per acre with advantage; but under such conditions the sewage would be very inadequately both utilized and purified, and a minimum amount of increase would be obtained for a given amount of sewage applied.

Looking, however, both to urban and to rural interests, and to purification as well as utilization, much more moderate applications than such as are required to yield the greatest amount of produce per acre, must be had recourse to. By way of practical suggestion on this point it may be stated that, on consideration of the circumstances under which the amounts of produce recorded in the Table were obtained, it is concluded that with an application of about 5,000 tons of average sewage per acre per annum, applied as it must be, pretty evenly throughout the year, there might be expected, taking the average of soils and seasons, an average of about 30 tons of grass. Assuming such a produce, and allowing £4 per acre for rent or natural yield, the grass would if sold at 10s. per ton, give a gross return of 0·53d. per ton of sewage employed, if for 12s. 6d. per ton 0·7d., and if for 15s. per ton 0·9d. From these amounts there would, of course, have to be deducted the cost of main distribution and application of the sewage, other expenses of the crop, and the farmer's profit, before

anything was available as payment to the town for the manurial matters.

In comparison with the result here assumed it may be observed hat in the neighbourhood of Croydon, where about 250 acres are id down for sewage irrigation, and where there are probably more ian 6,000 tons of sewage annually available for each acre, from 5 to 30 tons of meadow grass, selling for from £20 to £25, are tained per acre per annum; and after deducting as before £4 r rent, the gross return per ton of sewage employed is from 0·6d. 0·8d. With a somewhat similar application to Italian rye-grass, to 35 tons, selling for from £25 to £30 are obtained, yielding, ter deduction for rent or natural produce, from 0·8d. to 1d. per n of sewage employed. It will be observed that in these cases the lling price of the grass is 16s. or 17s. per ton; but it is obvious iat if sewage were extensively employed for the production of ass, its present price could not be maintained.

A marked effect of liberal sewage irrigation (indeed of active anures generally), on the mixed herbage of grass land, is greatly develope the Graminaceous plants, nearly to exclude the Leguinous, and to reduce the prevalence of miscellaneous or weedy lants, but much to encourage individual species. Among the rasses, according to locality or other circumstances, the rough ieadow grass (*Poa trivialis*), couch grass (*Triticum repens*), ough cock's foot (*Dactylis glomerata*), woolly soft grass (*Holcus anatus*), and perennial rye-grass (*Lolium perenne*), have been bserved to become very prominent; two or three only remaining n any considerable proportion after some years of liberal sewage pplication. But sewaged produce being generally cut or grazed omparatively young, the tendency which the great luxuriance of a ew very free-growing grasses has to give a coarse and stemmy later rowth is not an objection, as in the case of meadows left for hay.

The chemical examination of the grass grown at Rugby showed hat, at the stage of growth at which it was cut, the sewaged grass ontained a less proportion of dry or solid substance than the nsewaged; that the grass cut during the later portions of the eason (both unsewaged and sewaged) contained less solid matter han that cut during the more genial periods of growth; that the roportion of nitrogenous substance (and also of impure fatty or axy matter) was much greater in the solid matter of the ewaged than in that of the unsewaged grass; that the proporon of nitrogenous substance was also much higher in the

solid matter of the grass grown towards the end than earlier in the season: that the proportion of indigestible woody-fibre was much about the same in the dry substance of the unsewaged and of the sewaged grass, but progressively diminished as the season advanced; and, lastly, that a given amount of the dry substance of grass grown in a cold and wet season, or during the cold and wet periods of the year, generally contained more nitrogenous substance than that of grass grown in more genial weather.

It will be seen presently, that, with these differences in botanical and chemical character between the unsewaged and the sewaged grass, when used as food, a given quantity of the fresh unsewaged grass was more productive of both meat and milk than an equal weight of the fresh sewaged grass; but that a given weight of the dry or solid substance of the sewaged grass was more productive than an equal weight of that of the unsewaged. Further, the less nitrogenous grass of the more genial periods of the season was more productive than the more highly nitrogenous produce of the less genial periods.

Experiments were made at Rugby with Italian rye-grass as well as meadow-grass, but the results were not sufficiently distinct in their character from those above described to render it of much interest to consider them in this place.

The next points to consider are—the comparative food-qualities of unsewaged and sewaged grass, and the best or most profitable mode of utilizing sewage-irrigated grass.

When in the experiments at Rugby the grass was cut green, and given to fattening oxen tied up under cover, more of the sewaged than of the unsewaged, reckoned in the fresh or green state, was both consumed by a given weight of animal within a given time, and required to produce a given weight of increase: but of real dry or solid substance, less of that of the sewaged than of the unsewaged grass was required to produce a given effect. When the grass was given alone the result was very unsatisfactory, but when oilcake was given in addition, the amount of increase upon a given weight of animal within a given time, and for a given amount of dry substance of food consumed, was not far short of the average result obtained when oxen are fed under cover on a good mixed diet. Still, the pecuniary result with the oxen, whether reckoned per acre or for a given amount of sewage, was by no means satisfactory.

It should here be mentioned that, at Croydon, although the land there was more liberally irrigated than at Rugby, much more satisfactory results have been obtained with fattening stock fed on the land. The practice there is, to irrigate for three or four days and nights together, to repeat the treatment two or three times for each crop, and, when the grass has got a sufficient head, to stop the application and turn the stock upon the land, where they remain until the grass is closely eaten down. They are then removed, the land is re-irrigated, and so on.

Very much better results were obtained at Rugby when the grass was given to milking cows. Referring to the Report of the Sewage Commission for all further details, the summary of the results with cows given in Table IX. will suffice for consideration here.

It may be stated generally, that when the cows were fed on grass alone, as much as they chose to eat, a given weight of the animal was more productive, both of milk and increase, but especially of milk, on the unsewaged than on the sewaged grass. More milk was also produced from a given weight of the unsewaged grass, reckoned in the fresh or green state, than from an equal weight of the fresh sewaged grass. Of dry or solid substance, however, a given weight of that of the sewaged grass produced, on the average, more milk than an equal weight of that of the unsewaged.

The milk from the cows fed on the sewaged grass was, upon the whole, slightly the less rich, containing generally somewhat less casein, butter, sugar, and total solid matter (though more mineral matter) than that from the unsewaged; but when oilcake was given with the grass, whether sewaged or unsewaged, the richness of the milk was notably increased.

The productive quality of the grass was very different in different seasons, and at different periods of the same season, being very inferior in the wet and cold season of 1862, and towards the close as compared with the earlier periods of the seasons.

Without commenting further on the difference of result obtained under different conditions of season, or under other varying circumstances, it will be sufficient briefly to call attention to the more general results which the records in the table bring prominently to view, and to the practical conclusion which, on a careful consideration of all the circumstances and details, may seem to be safely deducible from them.

Table IX.

Results obtained at Rugby, with Cows fed on Unsewaged and Sewaged Grass, 1861, 1862, *and* 1863.

	Plot 1. Unsewaged	Plot 2. 3,000 Tons Sewage.	Plot 3. 6,000 Tons Sewage.	Plot 4. 9,000 Tor Sewage.
Time each acre (with oilcake, if any) would keep 1 cow :—				
	Weeks.	Weeks.	Weeks.	Weeks.
1861—Grass (alone)	19	41	59	69
1862—Grass (with oilcake).........	42	63	73	72
1863—{ Grass (½ without, ½ with oilcake) .... }	22	48	67	73
Means...	28	51	66	71
Milk from the Produce of each acre (exclusive of oilcake,* if any) :—				
	Gallons.	Gallons.	Gallons.	Gallons.
1861—Grass (alone)	321	571	820	961
1862—Grass (with oilcake).........	613	835	973	958
1863—{ Grass (½ without, ½ with oilcake) .... }	414	876	1207	1327
Means...	449	761	1000	1082
Value of milk from the produce of each acre (ex. of oilcake,* if any), at 8*d*. per gall				
	£ s. d.	£ s. d.	£ s. d.	£ s.
1861—Grass (alone)	10 14 3	19 0 6	27 6 11	32 0 1
1862—Grass (with oilcake).........	20 8 10	27 16 10	32 8 11	31 18 1
1863—{ Grass (½ without, ½ with oilcake) .... }	13 16 0	29 3 9	40 4 7	44 4
Means...	14 19 8	25 7 0	33 6 10	36 1
Increased produce of milk per 1,000 tons sewage applied (ex. of oilcake,* if any) :				
		Gallons.	Gallons.	Gallons.
1861—Grass (alone)		180	178	151
1862—Grass (with oilcake).........		74	60	38
1863—{ Grass (½ without, ½ with oilcake) .... }		154	132	101
Means...		136	123	97
Increased value of milk (at 8*d*. per gall.) per 1,000 tons sewage applied (ex. of oilcake,* if any) :—				
		£ s. d.	£ s. d.	£ s.
1861—Grass (alone)		5 19 10	5 18 8	5 0
1862—Grass (with oilcake).........		2 9 4	2 0 0	1 5
1863—{ Grass (½ without, ½ with oilcake) .... }		5 2 7	4 8 1	3 7
Means...		4 10 7	4 2 3	3 4

* The *value* of the milk, "exclusive of oilcake," is reckoned by deducting
cost of the cake consumed, less the estimated value of the manure it yields, from

It is seen that whether we reckon the total amount of food yielded per acre, or the amount, or the value, of the milk obtained from the consumption of the produce of each acre, there was a very great increase, varying from two to three-fold, according to season, by the use of sewage. The land upon which these experiments were made was good feeding pasture, of probably more than average quality, and the natural yield, without sewage, was, therefore, correspondingly high. Taking into consideration this fact, and other circumstances under which the results were obtained, it is concluded that, if not larger amounts of total produce per acre, at any rate larger amounts of increase for a given quantity of sewage may be expected when it is applied systematically over large tracts of land, with a view to the production of grass and milk.

It is estimated that with 5,000 tons of sewage per acre per annum, judiciously applied to Italian rye-grass or meadow-land properly laid down to receive it, an average *gross* produce of not less, and perhaps more, than 1,000 gallons of milk per acre per annum might be anticipated; and it may be observed that 1,000 gallons of milk at 8d. per gallon would represent a *gross* money return of £33 6s. 8d.

Putting the result in another way it may be stated that it required, according to circumstances, the consumption of between 5 and 6 tons of grass for the production of 1 ton of milk; and if we reckon 6 parts of grass for 1 of milk, and 30 tons of grass per acre, this would give a *gross* return in value of milk at 8d. per gallon of something over £37 per acre, or of about 25s. per ton, of grass consumed.

Still another illustration of the important bearing of the question of the utilization of the sewage of our town populations upon the re-production of food may be given. Supposing the whole of the sewage of a given population (which, however, would seldom be the case) were applied exclusively for the growth of grass for the production of milk, the result would be an increased yield of about 2½ pints of milk per week, or about ½ lb. per day, per head of such population. So far as the sewage were so applied, a portion of the milk produced would, of course, be represented, in con-

gross value inclusive of oilcake; and the *amount* of milk, "exclusive of oil-cake," by deducting from the gross amount of milk with oilcake at the rate of one gallon for every 8*d*. of deducted value. Such estimates are, however, obviously only approximations to the truth.

sumption, by its equivalent in butter and cheese. A portion of the grass would, however, be used directly for the production of meat; and, in addition to the milk and meat produced by the consumption of the grass, a large amount of solid manure would be obtained, which would be applicable to arable land for the growth of corn and other rotation crops.

It would appear, then, that if town sewage were to a great extent utilized by the application of something like 5,000 tons per acre per annum to Italian rye-grass and meadow-land, a direct result would be a very greatly increased production of important articles of human food which are at present both scarce and dear. But the question remains—would the sewage, by such an application, be sufficiently purified to allow of the drainage from the irrigated land being turned into rivers which are to be used as a water-supply for other towns? Some light will be thrown on this subject by the results next to be considered.

In order to determine how far, in the experiments at Rugby, the sewage was deprived of its manurial or putrescible constituents in its passage over and through the land, samples of the drainage water were collected for analysis in each field, simultaneously with those of the sewage, commencing in May, 1862, and ending in October, 1863. In all 62 partial analyses of drainage-water, corresponding in detail with those of the sewage, were made. A few other analyses, in much more detail, were made of the sewage and drainage of the season of 1864. The results of the large number of partial analyses are summarized in Table X, which shows, in parallel columns, the average composition of corresponding samples of sewage and drainage.

Table X.

Mean Composition of the Rugby Sewage before application, and of the Drainage-water from the Irrigated Land, in the Seasons 1862 *and* 1863.

Grains per Gallon.

Constituents.		Five-Acre Field.		Ten-Acre Field.		The two Fields.	
		Sewage.	Drainage.	Sewage.	Drainage.	Sewage.	Drainage.
Season 1862; May—October, both inclusive.							
		11 Samples.	8 Samples.	11 Samples.	11 Samples.	22 Samples.	19 Samples.
In suspension	Inorganic	25·67	1·81	24·89	3·74	25·28	2·92
	Organic	14·69	1·40	17·14	1·39	15·92	1·39
	Total..	40·36	3·21	42·03	5·13	41·20	4·31
In solution..	Inorganic	34·49	34·50	32·38	37·10	33·44	36·01
	Organic..	7·83	7·18	7·60	7·83	7·71	7·56
	Total..	42·32	41·68	39·98	44·93	41·15	43·57
Total inorganic..		60·16	36·31	57·27	40·84	58·72	38·93
Total organic ..		22·52	8·58	24·74	9·22	23·63	8·95
Total solid matter ..		82·68	44·89	82·01	50·06	82·35	47·88
Ammonia	In suspension	1·37	0·24	1·52	0·33	1·44	0·29
	In solution..	4·13	0·80	4·26	1·85	4·20	1·41
	Total..	5·50	1·04	5·78	2·18	5·64	1·70
Season 1863; November, 1862—October, 1863, both inclusive.							
		23 Samples.	21 Samples.	22 Samples.	22 Samples.	45 Samples.	43 Samples.
In suspension	Inorganic	39·41	2·14	34·93	3·93	37·22	3·06
	Organic..	27·35	1·41	25·99	3·29	26·69	2·37
	Total..	66·76	3·55	60·92	7·22	63·91	5·43
In solution ..	Inorganic	39·57	33·55	38·77	41·35	39·18	39·98
	Organic..	8·35	7·46	8·30	7·98	8·32	7·73
	Total..	47·92	46·01	47·07	49·33	47·50	47·71
Total inorganic..		78·98	40·69	73·70	45·28	76·40	43·04
Total organic ..		35·70	8·87	34·29	11·27	35·01	10·10
Total solid matter ..		114·68	49·56	107·99	56·55	111·41	53·14
Ammonia	In suspension	2·08	0·15	1·98	0·31	2·03	0·23
	In solution..	5·83	0·69	5·69	1·85	5·76	1·28
	Total..	7·91	0·84	7·67	2·16	7·79	1·51

It is seen that of matter in suspension in the sewage, nearly the whole, both inorganic or organic, was retained by the soil; and probably a considerable part of the little which the drainage-water contained was derived from the soil itself.

Of matter in solution, on the other hand, a gallon of the

drainage-water contained, on the average, much about the same amount, both inorganic and organic, as a gallon of the sewage; though, doubtless, a considerable portion of the soluble matters in the drainage had their immediate source in the soil—the sewage giving up valuable manurial matters to the soil, and the fluid in its turn taking up substances from it.

It is important to remark that the drainage from the more porous and less naturally fertile soil of the five-acre field (which, however, gave the largest amount of increase for a given amount of sewage), contained less of almost every constituent, or class of constituents, enumerated, than did that from the more argillaceous and more naturally fertile soil of the more steeply sloping ten-acre field. The result is particularly marked in the case of the ammonia. The fact here indicated is of considerable practical, as well as scientific, interest; and it is perfectly consistent with the results of common experience, which tend to show that a soil which may contain a comparatively small proportion of clay, but which is thoroughly porous, is, as a rule, much better adapted for sewage irrigation, both as regards the utilization and the purification of the sewage, than one which, though richer in clay and of higher natural quality, is but imperfectly permeable by the fluid.

The results given in Table XI show in more detail the changes in the composition of the fluid in its passage through the soil. They relate to samples of sewage and drainage taken in another field at Rugby, during very dry weather, in the summer of 1864. The plan of collection was, to take of sewage about a gallon, and of drainage about half a gallon, eight or ten times during the ten or twelve working hours of the day; at the end of the day, after well shaking, to take a gallon from each mixture; and to repeat this for six consecutive days, until six gallons of each were obtained, when after well shaking, a two-gallon sample of each was bottled off for the purposes of analysis.

Table XI.

Detailed Composition of samples of the Rugby Sewage before application, and of the Drainage-water from the irrigated land, collected July, 1864.

	Constituents.	Grains per Gallon.			
		Collected July 6—11.		Collected July 13—18.	
		Sewage.	Drainage.	Sewage.	Drainage.
In suspension.	Inorganic matter :—				
	Oxide of iron and alumina	4·57	...	6·30	...
	Lime	4·48	...	3·75	...
	Magnesia	0·65	...	0·25	...
	Carbonic acid	3·25	...	2·17	...
	Phosphoric acid	1·84	...	1·14	...
	Silica, sand, &c.	31·60	...	39·30	...
	Total	46·39	...	52·91	...
	Organic matter	40·40	...	32·40	...
	Total matter in suspension	86·79	...	85·31	...
In solution.	Inorganic matter :—				
	Oxide of iron, &c.	Traces.	...	1·25	0·25
	Lime	8·45	10·25	8·23	10·08
	Magnesia	1·76	1·69	1·80	1·69
	Soda (1)	5·46	0·38	5·24	2·30
	Chloride of sodium (1)	6·82	9·73	8·53	9·21
	Chloride of Potassium (1)	6·08	1·50	6·17	2·34
	Sulphuric acid	4·39	6·55	4·01	6·75
	Phosphoric acid	1·28	0·44	1·66	0·32
	Carbonic acid	8·83	6·18	7·42	7·01
	Silica	1·80	0·80	1·00	0·80
	Total	44·87	37·52	45·31	40·75
	Organic matter	11·20	7·80	10·00	7·05
	Total matter in solution	56·07	45·32	55·31	47·80
	Total inorganic matter	91·26	37·52	98·22	40·75
	Total organic matter (2)	51·60	7·80	42·40	7·05
	Total solid matter	142·86	45·32	140·62	47·80
(1) Containing	Potassa	3·84	0·94	3·90	1·48
	Soda	9·07	5·54	9·76	7·17
	Chlorine	7·03	6·61	8·10	6·70
(2) Containing	Ammonia — In suspension	2·92	...	2·42	...
	Ammonia — In solution	5·74	0·98	6·36	0·92
	Ammonia — Total	8·66	0·98	8·78	0·92
	Nitric acid in solution = Ammonia	......	(3) 1·33	...	(4) 1·41

(3) 4·227 Nitric acid = 1·096 Nitrogen = 1·331 Ammonia.
(4) 4·483 „ = 1·162 „ = 1·411 „

The soil was light and gravelly, with a gravelly subso: an examination of the figures in Table XI shows, that done the work of absorption, at any rate as well as, if not than, on the average, did the soils in the other fields. intended to take samples for detailed analysis from this field various conditions of the weather, but owing to the continu the drought, this could not be accomplished.

In judging of these results, as well as those already cons it must, of course be borne in mind that, excepting wh land is already saturated with water, a gallon of draina represent much more than a gallon of sewage; and that, the amount of any constituent of the sewage found in a ga the drainage must have been derived from more than a ga the former. The non-retention of valuable manurial mat the soil was, therefore, not so great as would at first sight on an inspection of the comparative composition of equal v of the sewage and of the drainage.

As in the larger number of cases, so in these, the quan matter in suspension in the drainage was very small, an obviously in great part derived from the soil, it was not sul to quantitative analysis. A considerable proportion of th phoric acid of the sewage was in suspension, but there wa of it in suspension in the drainage, the whole of the por existing in the sewage having been retained by the soil.

It is satisfactory to observe that among the inorganic const in solution in the sewage, by far the larger proportion o which are, perhaps, the most likely to become relatively de was retained by the soil. Thus, smaller proportions of b potassa and the phosphoric acid of the sewage passed off drainage than of any other constituents. Soda was also r by the soil to a considerable extent, magnesia in a less degr lime less still. Of lime, indeed, there was more in a ga drainage than in a gallon of sewage; of sulphuric acid als was considerably more in the drainage than in an equal vol the sewage. Lastly, of soluble silica a notable portion pa in the drainage.

Of organic matter in solution a very considerable quanti found in the drainage-water. The character of the soluble o matter in the drainage is, however, very different from that sewage. It contains very much less ammonia, or ammoni ing matter; and, especially in periods of active vegetatio

doubtless, frequently be derived from vegetable matter within the soil, rather than directly from the sewage.

A very important point to remark is, that, whilst the sewage scarcely contained an appreciable amount of nitric acid, the drainage contained more nitrogen in that form than as ammonia; the result being that the soil had retained a considerably less proportion of that important manurial constituent of the sewage than would have been supposed had only the more partial analyses been made.

The general result was, that, practically, the whole of the insoluble or suspended matter of the sewage was retained by the soil; and that, of the constituents of the sewage, whether in suspension or in solution, those which are of the most value, because the most liable to become relatively exhausted, were the most efficiently retained. Nevertheless, the drainage-water still retained so much of potassa, phosphoric acid, ammonia, and nitric acid, as clearly to show that the sewage had not been perfectly deprived of its valuable manurial matters, and also so much of total soluble matter, especially of soluble organic matter, as to show that it had not been by any means perfectly purified.

There is, indeed, a limit to the power which a soil possesses of removing substances from solution, or of preventing those already absorbed from being dissolved in water passing through it, the result being dependent on the physical and chemical characters of the soil itself, and on the amount and composition of the fluid passing through it. So far as the soluble organic matters of the drainage are derived from vegetable matter within the soil, it is a question whether there will not always be a considerable amount in that passing from land covered with luxuriant vegetation. So far, however, as the nitrogen of the drainage exists in the form of nitric acid, it is a pretty satisfactory indication that the organic matter has, to a great extent, already passed the stage of deleterious putrescence.

In the Rugby experiments the arrangements were not such as to allow of the water drained from one portion of the land being passed over another; but at Beddington, near Croydon, a great portion of the water does duty twice, and sometimes three times; and from results kindly communicated by Mr. Latham, the engineer to the Croydon Board of Health, and given in the following table, it would appear that there the water eventually passes from the land in a state of much greater purity than was the case in the Rugby experiments.

Table XII.

Partial Analyses of the Croydon Sewage before application, of the Drainage-water from the irrigated land, and of the River Wandle, above and below the Drainage Outfall from the irrigated land.

Constituents.	Croydon.		River Wandle.	
	Sewage.	Drainage.	Above Drainage Outfall.	Below Drainage Outfall.
	Grains per gallon.			
Inorganic matter	48·30	23·40	18·56	20·16
Organic matter	52·20	2·40	1·44	2·08
Total solid matter	100·50	25·80	20·00	22·24
Ammonia	6·70	0·21	0·18	0·18

The figures show much about the same amount of ammonia in the Sewage of Croydon, as was found on the average in that at Rugby; but the amount in the Croydon drainage was extremely small. It is unfortunate that the quantity of nitric acid was not also determined; but we are informed that it undoubtedly exists in some amount in the drainage from the Beddington meadows. Still, although formerly the Croydon Board had to meet numerous law-suits on account of the pollution of the river by the sewage, the fluid is now so far purified before being discharged, that those having the right of fishing in the river have found it worth while to fix gratings to prevent the fish going up the main outfall from the sewage-irrigated land.

The results obtained in regard to this part of the subject—that of purification—however interesting and important, must still be looked upon as little more than initiative; but there can be no doubt that, when large quantities of sewage are applied to grass-land, the arrangements should be such as to allow of the drainage-water being collected and re-used in such a manner as to insure as far as possible both complete utilization and complete purification. It must be admitted, however, that further experience, and further investigation, are still wanting, to determine what amount of sewage, provided the drainage water be properly re-distributed, can be

safely applied to a given area, under different conditions of soil and subsoil, and under different conditions of season, so as to insure its sufficient purification.

Experience of Common Practice in the Utilization of Sewage.

Leaving the results of experimental inquiry, it will be well briefly to notice those of practical experience hitherto, in regard to the value and utilization of town sewage. The instance most frequently quoted is that of the neighbourhood of Edinburgh, relating to which some particulars are given in the following Table:—

TABLE XIII.

Relating to the Sewage-irrigated Meadows near Edinburgh.

Names of Meadows.	Imperial Acres under Irrigation.	Approximate Population contributing to each Acre.	Approximate Quantity of Sewage available for each Acre.
			Tons.
Lochend, Spring Gardens, and Craigentinny	285	337	20,500
Roseburn and Western Dalry	80	112	17,000
Quarry Holes	8	562	65,000
Broughton Burn	6	1,666	102,000
The Grange	16½	302	97,000

These tabular statements are chiefly based upon direct information, obtained in part from Mr. McPherson, the Edinburgh City Surveyor, and in part from the occupiers or managers of the respective meadows. To prevent misunderstanding, however, it must be explained with regard to them, that, as water-closets are not universal, and as the sewage is frequently allowed to pass unused, the records of the amount of population contributing to, and of sewage available for, each acre, do not show the amounts actually utilized, but only approximately the total amounts available, whether used or wasted.

Sewage has been applied to some portions of the land in the neighbourhood of Edinburgh for about 200 years, to a considerable portion for more than 60, and to most of that now under irrigation for more than 30 years. In two instances arrangements have been made for raising the sewage, by pumping, an inconsiderable

number of feet; but the cost has been found too great to allow a sufficient quantity being applied per acre, and hence the ap cation in this way has been much limited, if not on some porti of the land entirely abandoned. The application is confined meadow land and Italian rye-grass, and the distribution is entire by means of open runs. When Italian rye-grass is grown, tl land is periodically broken up, and one or two other crops take without sewage before laying down again to grass. The applic tion to ordinary rotation crops on arable land forms no part the system adopted.

There is no doubt that at Edinburgh larger amounts of sewa are applied per acre than anywhere else, and that it is under the conditions that there are there obtained larger amounts of produ per acre than anywhere else. Nor is there any doubt, on t other hand, that there is, at Edinburgh, not only very great wa of manurial constituents, but very imperfect purification of t sewage. Hence the experience there, however interesting a important in some points of view, cannot be taken as the foun tion either of estimates of the value realizable in practice by utilization of given amounts of sewage, or of the sewage of given population, or of safe conclusions as to the amount of sew that can advantageously be applied per acre when the drain has to be passed into a river, which may have to serve as water-supply of other towns, instead of, as at Edinburgh, hav an immediate outfall into the sea.

It may be mentioned that generally four or five crops of gr are obtained per acre annually, amounting, according to circu stances, to 30, 40, 50, 60, and even more tons per Imperial ac and selling for prices varying from £8 to over £40 per acre, averaging perhaps about £25. These results are, indeed, su ciently striking, and well merit careful inquiry and considerati but, for the reasons above stated, the exact practice of Edinbu is not applicable to towns generally, and is especially inapplica to inland towns.

Table XIV summarizes the results of the experience of most important instances of sewage utilization in other locali

TABLE XIV.

Relating to Sewage-irrigation in various localities.

wns.	Population contributing.	Acres.		Crops. &c.	Annual Payment to Towns
		Original	Reduced.		
ck......	6,500	270	0	Arable and grass; abandoned	Nothing
le	22,000	70	...	Meadow grass; all grazed	?
on	16,000	250	...	Meadow and rye-grass	£300
rn	4,000	50	...	Grass	Nothing
....	6,700	190 280	20 100	Meadow and rye-grass Meadow; chiefly grazed	£50
tock ...	6,000	95	...	Grass	Nothing
ord......	4,000	210	7 35	Rye-grass—Summer. Meadow grass—Winter	£10
ing ...	7,000	42	...	Grass; not yet at work	Nothing

t Alnwick, the late Duke of Northumberland put down hinery and piping for the distribution of the sewage of the n over about 270 acres of mixed arable and grass land. After ry short time, the tenants, who had the free use of the sewage the cost of its application, abandoned it altogether; and the liff of the District, who reports the failure, expresses his opinion ngly against the general applicability of sewage to arable l.

t Carlisle, the sewage of only a portion of the town is utilized. is deodorized by Mr. McDougall's disinfecting fluid, and ed by steam power some 10 or 12 feet into an open cut, from ch it is diverted for application to the land by moveable iron ighs. It is estimated that from 8,000 to 9,000 tons of sewage applied per acre per annum. It is understood that little or hing is realized by the town; but that the tenant makes a siderable profit by sub-letting the sewage-irrigated land for zing purposes.

n the Neighbourhood of Croydon, as already referred to, the 'age of nearly 20,000 persons is applied to about 250 acres of adow and Italian rye-grass. It is calculated that more than 00 tons of sewage are available for each acre. A considerable tion of the fluid is used two or three times over; and it finally

passes from the land pretty satisfactorily purified. It is est mated that, after making deduction of £4 for rental, the *gr* return per ton of sewage applied is, at the present prices of t produce, with Italian rye-grass from ¾d. to 1d., and with mead grass from ½d. to ¾d. The sewage is not applied in any systemat manner to other crops, but it has been tried on a small scale root-crops. An enlargement of the area of irrigation is conte plated, which will, if carried out, somewhat reduce the amount fluid and excretal matters available per acre below the quantiti above stated.

About 12 years ago, arrangements were made for collecting t sewage of Rugby in a tank, from which it is pumped, by a 12-hor power engine, through iron pipes laid down for the distributi over about 470 acres of mixed arable and grass land. Up to la year 190 acres were held by Mr. James Archibald Campbe but he has gradually limited the area of application, and duri the last few years has abandoned the use of hose and jet, excepti occasionally on a small scale, and confined the application almo exclusively to from 12 to 20 acres of meadow and Italian ry grass. The remainder of the land, amounting to about 280 acre has passed through the hands of two tenants, both of whom a said to have sustained considerable loss. The last of the two h confined the application almost exclusively to about 100 acres grass land, and applied the sewage almost entirely by open ru The whole is now in the hands of the landlord, Mr. G. H. Walk who, it is understood, is contemplating the abandonment of use of steam power, pipes, and hose and jet, and the applicatio a limited area by means of gravitation.

The general result at Rugby is, then, that after about a do years of practical experience, with arrangements adapted for application of small quantities of sewage per acre, to arable as as to grass land, and to all crops, the area has been gre limited, the use to any other crops than meadow and Italian r grass is quite exceptional, and the application by means of ste power, pipes, and hose and jet, will probably soon be enti abandoned. It may be added that, at the time of the experime of the Commission, the sewage, which was considerably stro than that of the Metropolis, cost the tenants only about ¾d. ton at the hydrants in the fields; yet, rather than incur the los using it at that cost, both were glad to get rid of it to the C mission, at rates which, though three times as high during

six summer as during the six winter months, averaged the year round scarcely, but very nearly, 1d. per ton at the hydrants.

Some years ago, the Earl of Essex laid down pipes for the application of the sewage of Watford, by pumping and hose and jet, to about 210 acres of mixed arable and grass land. The results which his Lordship obtained on the application of only 134 tons of sewage per acre to wheat have frequently been held to be conclusive proof of its applicability in small quantities per acre over large areas, to arable land, and to all crops. But in the evidence given by his Lordship before the Sewage Committee of 1862, he stated, very emphatically, that his great error had been the piping of too much land; that he required 5,000 tons per acre for 10 acres of rye-grass; and that, applying the remainder to 35 acres of meadow, he had none to spare for wheat. In other words, although the abandonment of one acre of rye-grass would set free sewage enough for nearly 40 acres of wheat, if applied only at the rate which yielded the large gross return per ton of sewage so frequently quoted, yet his Lordship's practical experience had led him to prefer the application to the one acre of rye-grass rather than to the nearly 40 acres of wheat. Further, his Lordship gave it as his opinion that sewage would not be profitable to the farmer unless he could have it at from ½d. to ¾d. per ton.

Referring to the question of the application of sewage to corn crops, it may be stated that, in an experiment made by the Commission at Rugby, with oats, a very high gross money return per ton of sewage was also obtained. The experiment was made in the unusually productive season of 1863, and with sewage of about double the average strength of that of the Metropolis, applied during a period of very dry weather. The results were, therefore, quite exceptional, and cannot be taken as affording any indication of what might be expected from the application of small quantities of sewage to corn crops generally, on different soils, and on the average of seasons. There cannot, indeed, be a doubt, that to obtain a maximum gross value of produce from a given amount of sewage, it should be applied in small quantities per acre, and in dry weather. But sewage is produced in large daily amount at all seasons, and must be disposed of as soon as it is produced. It must, therefore, be applied in winter, when of comparatively little value, as well as in summer, when of more, and it would frequently be quite inapplicable to arable land. Moreover, to obtain an increased gross money return per ton of sewage by using it on a

comprehensive scale for corn and other ordinary rotation crops, would involve the extra cost of main distribution over at least a ten-fold, if not frequently a twenty-fold area, and require the application to a great extent by the expensive means of pipes and hose and jet, instead of by the economical one of open runs.

At Malvern and Tavistock the application of sewage to grass land has now been carried on for some years, but at Worthing it has only very recently been commenced.

From this short review of the experience of practical men who have undertaken the utilization of sewage with a view to profit, it appears that, wherever arrangements have been made for the application of small quantities over large areas, to corn and other rotation crops on arable land, and by means of pipes and hose and jet, the undertaking has either been entirely abandoned, or the area greatly limited, and the application confined almost exclusively to meadow and Italian rye-grass. On the other hand, the undertakings which have been the most successful from the agricultural point of view are those in which the arrangements have been adapted for the almost exclusive application to grass, and the application to other crops is only exceptional.

General Practical Conclusions.

The practical conclusions deducible from the whole inquiry may be briefly stated as follows:—

1. It is only by a liberal use of water that the refuse matters of large populations can be removed from their dwellings without nuisance and injury to health.

2. That the discharge of town sewage into rivers renders them unfit as a water supply to other towns, is destructive of their fish, causes deposits which injure their channels, gives rise to emanations which are injurious to health, is a great waste of manurial matter, and should not be permitted.

3. That the proper mode of both utilizing and purifying sewage is to apply it to land.

4. That, considering the great dilution of town sewage, its constant daily supply at all seasons, its greater amount in wet weather when the land can least bear, or least requires, more water, and the cost of distribution, it is best fitted for application to grass, which alone can receive it the year round. It may, however, be

asionally applied with advantage to other crops within easy ch of the line or area laid down for the continuous application grass.

. That, having regard both to urban and rural interests, an application of about 5,000 tons of sewage per acre per annum, to meadow Italian rye-grass, would probably, in the majority of cases, ve to be the most profitable mode of utilization, though the antity would have to be reduced, provided experience showed that water was not sufficiently purified; and it is pretty certain that farmer would not pay ¾d., and it is even very doubtful whether could afford to pay ½d. per ton, the year round, for sewage he average strength of that of the Metropolis (excluding stormer) delivered on his land.

. That the direct result of the general application of town age to grass land would be an enormous increase in the protion of milk, butter, cheese, and meat; whilst, by the conaption of the grass, a large amount of solid manure, applicable arable land and to crops generally, would be produced.

. That the cost or profit to a town of arrangements for the noval and utilization of its sewage must vary very greatly, ording to its position, and to the character and levels of the d to be irrigated. Where the sewage can be conveyed by vitation, and a sufficient tract of suitable land is available, the n may realize a profit; but, under contrary conditions, it may ve to submit to a pecuniary sacrifice to secure the necessary itary advantages.

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FOOD IN ITS RELATIONS

TO

VARIOUS EXIGENCIES OF THE ANIMAL BODY.

THE appearance in the June (Supplementary) Number of the Philosophical Magazine of the interesting paper by Professors Fick and Wislicenus "On the Origin of Muscular Power," and the further interest excited in the subject by Professor Frankland's recent lecture at the Royal Institution, seem to render it opportune that the important question of the connexion between certain constituents of food and certain exigencies of the animal body should receive a little further consideration at the present time. Professor Frankland truly said that, since the appearance of Baron Liebig's masterly and highly suggestive work 'On Organic Chemistry in its applications to Physiology and Pathology' in 1842, his views of the relation of the nitrogenous and the non-nitrogenous constituents of food to certain requirements of the animal organism have been pretty generally adopted by text-book writers. It is also true, that authorities on the subject of the chemistry of food have, even so recently as last year and this, either directly maintained or taken for granted the correctness of Baron Liebig's views. It is, however, not the case, as was also assumed by Professor Frankland, that those views have remained unquestioned excepting in the one or two instances of criticism to which he referred.

This question, in various aspects, has occupied a great deal of our own attention for many years past; and so long ago as 1852, we advocated substantially the views now adopted by Professors Fick, Wislicenus, and Frankland; and we have on various occasions since that date expressed them with greater definiteness, and urged them the more emphatically, as new experimental evidence either of others or ourselves seemed to lend them support or confirmation. It may be well, therefore, to state very briefly

the course of our own investigations bearing upon the subj€ and also the conclusions that we have based upon them.

In Baron Liebig's work above alluded to, and also in sub quent publications, he treated of the food requirements of t animal body generally—that is, under different conditions; a starting from the fundamental assumptions, on the one hand, the direct connexion of the nitrogenous or, as he designa them, the "*plastic*" constituents of food, not only with the f mation in the animal body of the compounds containing nitrog but also with the development of muscular power, and, on t other, of the general relationship of the non-nitrogenous c stituents of food with respiration, the development of heat, a the deposition of animal fat, he concluded that the relati value of different foods, as such, was to a great extent depen ent on, and even measurable by, the proportion of nitrogen constituents which they contained.

It was upon the assumption of the broad and fundamen classification of the constituents of food according to their vario offices in the animal economy, as above stated, that numer analyses of food were undertaken, and, founded upon the resu obtained, Tables constructed professing to arrange current artic of food, both of man and other animals, according to their co parative values as such; and whether the object were the feedi of animals for the production of milk, the so-called fattening them for the production of meat, or the support of the body i the exercise of muscular power, the proportion of nitrogen constituents was generally taken as the measure of that value.

Omitting, for the sake of brevity, any special reference to t labours or views of others, it will suffice here to make a few su quotations from Baron Liebig's works as will best convey shor in his own words a pretty clear indication of his own vie and at the same time pretty fairly represent those of a large p portion both of systematic writers and experimenters, on t points in question. Speaking of the nitrogenous constituents food, he said :—

"It is found that animals require for their support less of a vegetable food in proportion as it is richer in these peculiar m ters, and cannot be nourished by vegetables in which these m ters are absent." (Chemical Letters, 3rd edition, p. 349.)

Again :—

"The admirable experiments of Boussingault prove, that t increase in the weight of the body in the fattening or feeding stock (just as is the case with the supply of milk obtained fr milch cows), is in proportion to the amount of plastic constitue in the daily supply of fodder." (Chemical Letters, 3rd edit. p. 36

In regard to the exercise of force, he said :—

"As an immediate effect of the manifestation of mechanical force, we see, that a part of the muscular substance loses its vital properties, its character of life; that this portion separates from the living part, and loses its capacity of growth and its power of resistance. We find that this change of properties is accompanied by the entrance of a foreign body (oxygen) into the composition of the muscular fibre (just as the acid lost its chemical character by combining with zinc); and all experience proves, that this conversion of living muscular fibre into compounds destitute of vitality is accelerated or retarded according to the amount of force employed to produce motion. Nay, it may safely be affirmed, that they are mutually proportional; that a rapid transformation of muscular fibre, or, as it may be called, a rapid change of matter, determines a greater amount of mechanical force; and conversely, that a greater amount of mechanical motion (of mechanical force expended in motion) determines a more rapid change of matter." (Organic Chemistry in its application to Physiology and Pathology, 1842, pp. 220 & 221.)

And again:—

"The amount of azotized food necessary to restore the equilibrium between waste and supply is directly proportional to the amount of tissues metamorphosed.

"The amount of living matter, which in the body loses the condition of life, is, in equal temperatures, directly proportional to the mechanical effects produced in a given time.

"The amount of tissue metamorphosed in a given time may be measured by the quantity of nitrogen in the urine.

"The sum of the mechanical effects produced in two individuals, in the same temperature, is proportional to the amount of nitrogen in their urine; whether the mechanical force has been employed in voluntary or involuntary motions, whether it has been consumed by the limbs or by the heart and other viscera." (Ibid. p. 245.)

Our own direct experiments have had reference chiefly to the feeding of fattening animals; but the characteristic food requirements of the body, when fed with the view to the exercise of muscular power, have also been made the subjects of enquiry.

Referring to the feeding of fattening animals, the question arises, whether in the use of the currently adopted food-stuffs *the amount of food consumed by a given weight of animal within a given time*, and *the amount of increase produced*, are more influenced by the amount of the nitrogenous or of the non-nitrogenous constituents which the food supplies; that is to say, whether the sum of the requirements of the animal system under these circumstances is such that, in the use of the ordinary articles of food, the *amount taken* or *increase produced* will

be more regulated, or measurable, by the supplies of the nitrogenous or "flesh-forming" constituents, or by those of the more specially respiratory and fat-forming non-nitrogenous constituents.

To acquire the data necessary for the satisfactory solution of this question, some hundreds of animals—oxen, sheep, and pigs—have been experimented upon. Comparative lots being selected, the general plan of the feeding-experiments was to give to some a fixed and limited amount of food of known composition in regard to its contents of nitrogenous and non-nitrogenous constituents, to others a fixed and limited amount of food of different composition in this respect, and to allow all to take as much as they chose to eat of some other food, also of known composition, the quantity consumed being weighed. In some cases a single description of food only, or a mixture of several descriptions in known proportions, was given *ad libitum*, but weighed; and in others, several descriptions of food were allowed, each separately, *ad libitum*, but weighed. It will be seen that in this way great variation in the amount and proportion of the nitrogenous and non-nitrogenous constituents supplied was attained, whilst the animals, according to the nature of the food within their reach, fixed for themselves the limit of their consumption. All such comparative experiments were conducted for many weeks, or even for several months, consecutively, and the weights of the animals themselves were determined at the commencement, at stated periods during the progress, and at the conclusion of the experiment.*

To determine the character and composition of the gross increase in live-weight, the weights of the individual internal organs and of other separated parts of several hundred animals of different descriptions and in different conditions as to age, maturity, and fatness, were taken; whilst in some carefully-selected cases the total amounts of fat, nitrogenous substance, mineral matter, and water, were determined †.

* "On the Composition of Foods in relation to Respiration and the Feeding of Animals," Report of the British Association for the Advancement of Science for 1852." "Agricultural Chemistry: Sheep-Feeding and Manure," part 1, Journ. Roy. Ag. Soc. Eng. vol. x. part 1, 1849. "Reports of Experiments on the Comparative Fattening Qualities of different Breeds of Sheep," ibid. vol. xii. part 2, 1851; vol. xiii. part 1, 1852; vol. xiv. part 1, 1853. "Agricultural Chemistry: Pig Feeding," ibid. vol. xiv. part 2, 1853. "On the equivalency of Starch and Sugar in Food," Rep. Brit. Assoc. for 1854.

† "Experimental Inquiry into the Composition of some of the Animals Fed and Slaughtered as Human Food," Phil. Trans. part 2, 1859; also Proceedings of the Royal Society, vol. ix. p. 348. "On the Composition of Oxen, Sheep, and Pigs, and of their Increase whilst Fattening," Journ. Roy. Ag. Soc. Eng. vol. xxi. part 2, 1860. "On the Chemistry of the Feeding of Animals for the production of Meat and Manure," Proc. Roy. Dub. Soc. March 31, 1864.

that, in the case of fattening animals, the amount ed *in relation to a given body-weight within a given* gulated, not only by the demands of the system of respiration, perspiration, &c., and for the repair te of nitrogenous substance, but also by the addi- ents for growth and increase; whilst, on the other unt required to be consumed *for the production of t of increase* will, in its turn, include that due to f the system for respirable and perspirable matter of the waste of nitrogenous substance. Whether, xperimental results were calculated so as to show nsumed per 100 lbs. live-weight per week, or to s. increase in live-weight, it was strikingly brought parable experiments, that it was in neither case the rogenous constituents, but in both the amount of available non-nitrogenous (or total organic) sub- od that had regulated the results obtained.

e reader to our former papers for all experimental the fuller discussion of the results and statement ons, we will close this part of the subject in words paper given at the Meeting of the British Asso- ast in 1852*. The sentence as quoted had refer- sults obtained with sheep; but subsequently those pigs were summarized in almost the same words:— consider that it is the results obtained under the of animal life that we are seeking to measure and es, and if we also bear in mind the various sources to which our actual figures must be submitted in their true indications, we think that it cannot be beyond a limit below which few, if any, of our ng food-stuffs are found to go, it is their available s constituents, rather than their richness in the es, that measure both the amount consumed to a f animal, within a given time, and the increase in d."

nind the nature of the respiratory process, and the which its demands must necessarily exercise over food consumed, it will scarcely appear surprising *n* at least should be chiefly regulated by the sup- od of non-nitrogenous constituents; but that *the ease* obtained in feeding animals for the butcher ear a closer relationship to the supply of the s than to that of the nitrogenous constituents,

mposition of Foods in relation to Respiration and the ials," Report of the British Association for the Advance- for 1852.

might perhaps well be looked upon as inconsistent with the currently adopted views as to the highly nitrogenous character of the increase of animals fed for human food, and, indeed, of the highly nitrogenous character of the animal portion of human food generally.

The investigation into the composition of the fattening animals, and their increase, above alluded to, showed, however, how small was the proportion of the nitrogenous substance of the food that was stored up in the increase of the animal, and also that the proportion of fat in the increase was much greater than had previously been supposed. The results further led to the remarkable conclusion, that, reckoning the fat of the estimated total consumed portions of animals admitted to be in only a proper condition of fatness, into its starch-equivalent, there was, on the average, a higher proportion of so-reckoned non-nitrogenous substance to one of nitrogenous substance in such animal food than in bread itself. It was concluded, indeed, that, on the large scale, the introduction of animal aliments into our otherwise chiefly farinaceous diet did not increase, but diminish the *relation* of the nitrogenous or so-called "flesh-forming," to the non-nitrogenous constituents (reckoned according to their respiratory and fat-forming capacity) in the collective food. The important bearing of these facts in forming an estimate of the characteristics of different human dietaries will be at once apparent.

So much, then, for the characteristic food requirements of animals exposed to as little exertion as possible, and fed with the express view of accumulating flesh and fat in their bodies. Concurrently with the earlier experiments to determine the relations of food and body-weight and increase above referred to, the question of the relation of the amount of the constituents voided (especially the nitrogen) in the liquid and solid excrements to that in the food consumed, was also investigated. Consistently with the results obtained in regard to the amount and character of the increase resulting from the consumption of very different amounts of nitrogenous substance, it was found that the amount of nitrogen voided by fattening animals fed under equal conditions as to the exercise of force, bore a very direct relation to that supplied in the food. So direct, indeed, is the connexion between the composition of the matters excreted and that of the food consumed, that we have constructed Tables showing the relative value of the manure produced by fattening animals from a given weight of different food-stuffs according to the composition of the latter.

But more to our present purpose—so striking were the results obtained in regard to the connexion between the compos-

tion of the food on the one hand, and the amount consumed, the amount and character of the increase produced, and the composition of the excreted matters, on the other, and, on some important points, so contrary in their indications to the prevailing views, that we were led at once to turn our attention to human dietaries, and especially to a consideration of the management of the animal body undergoing somewhat excessive labour, as, for instance, the hunting horse, the racer, the cab-horse, and the foxhound, and also pugilists and runners. The conclusions to which we were led by this study were briefly summarized in 1852 as follows * :—

"........ that in the cases, at least of ordinary exercise of force, the exigencies of the respiratory system keep pace more nearly with the demand for nitrogenous constituents of food than is usually supposed ;"

And further :—

"A somewhat concentrated supply of nitrogen does, however, in some cases, seem to be required when the system is over-taxed; as for instance, when day by day, more labour is demanded of the animal body than it is competent without deterioration to keep up; and perhaps also, in the human body, when under excitement or excessive mental exercise. It must be remembered, however, that it is in butcher's meat, to which is attributed such high flesh-forming capacity, that we have also, in the fat which it contains, a large proportion of respiratory material of the most concentrated kind. It is found, too, that of the dry substance of the *egg*, 40 per cent. is pure fat.

"A consideration of the habits of those of the labouring classes who are under- rather than over-fed, will show, that they first have recourse to fat meat, such as pork, rather than to those which are leaner and more nitrogenous; thus perhaps indicating, that the first instinctive call is for an increase of the respiratory constituents of food. It cannot be doubted, however, that the higher classes do consume a larger proportion of the leaner meats; though it is probable, as we have said, that even with these as well as pork, more *fat*, possessing a higher respiratory capacity than any other constituent of food, is taken into the system than is generally imagined. Fat and butter, indeed, may be said to have about twice and a half the respiratory capacity of starch, sugar, &c. It should be remembered, too, that the classes which consume most of the leaner meats, are also those which consume the most butter, sugar, and in many cases, alcoholic drinks also.

"It is further worthy of remark, that wherever labour is expended in the manufacture of staple articles of food, it has

* Report of the British Association for the Advancement of Science for 1852.

generally for its object the concentration of the *non* genous, or more peculiarly respiratory constituents. butter, and alcoholic drinks are notable instances of this. (which at first sight might appear an exception, is in reali so; for those cheeses which bring the highest price are ; those which contain the most butter; whilst butter it always dearer than cheese.

"In conclusion, it must by no means be understood tl would in any way depreciate the value of even a son liberal amount of nitrogen in food. We believe, ho that on the current views too high a relative importance tached to it; and that it would conduce to further progı this most important field of enquiry if the prevailing oı on the subject were somewhat modified." *

It will be borne in mind that, at the time the statem view here quoted was made, the opinions expressed were d contrary to all recognized authority on the subject, an(since that date that so much evidence has been accum in regard to the amounts of urea, and the amounts of ca acid and other products, given off under varied conditions food and exercise. Still, from the facts even then at comma was concluded that the increased demand for food re from the exercise of muscular power was specially charac by the requirement for an enhanced amount of the non-n nous constituents. Confirmatory evidence was, howeve long wanting.

In 1854 we selected two pigs as nearly as possible of weight and character; to one was given, *ad libitum*, lent (containing about 4 per cent. of nitrogen), and to the other, ; *libitum*, barley-meal (containing less than 2 per cent.). Aft animals had been kept for a certain time on their res foods, one comparative experiment was conducted for a of three days, and another for a period of ten days. weights of the animals were taken at the beginning and end of each experiment, and, besides other particula amounts of nitrogen consumed in food, and voided as were determined.† The result was, that with exactly conditions as to exercise, both animals being in fact at re amount of urea passed by the one feeding on the highly genous lentil-meal was more than twice as great as that

* It is worthy of remark, too, that neither are the most highly n nous wheats the most valued by the baker for the purposes of bread-n nor is the most highly nitrogenous bread the most valued by the chiefly fed working man. See "On some Points in the Composition of ' grain, its Products in the Mill and Bread," Journ. Chem. Soc. vol. :

† Phil Trans. part 2, 1859, p. 554.

by the one fed on the barley-meal. We have since made other such experiments with similar results.

It was clear, therefore, that the rule laid down by Liebig, and assumed to be substantially correct by so many writers, did not hold good—namely, that " The sum of the mechanical effects produced in two individuals, in the same temperature, is proportional to the amount of nitrogen in their urine; whether the mechanical force has been employed in voluntary or involuntary motions, whether it has been consumed by the limbs or by the heart and other viscera"—unless, indeed, as has been assumed by some experimenters, there is, with increased nitrogen in the food, an increased amount of mechanical force employed in the "involuntary motions" sufficient to account for the increased amount of urea voided.

It was at any rate obvious that, if the amount of urea voided by one animal at rest could be from two to three times as great as that voided by a similar animal also at rest, and under otherwise equal conditions, provided only that the food of the one contained from two to three times as much nitrogen as that of the other, the amount of urea passed could not be any measure of the amount of muscular power exerted; and this evidence, considered in connection with that relating to the demands of the system not only of the fattening animal but of the animal body fed with a view to mechanical exertion, afforded further confirmation of the view we had already put forward as above quoted, and also led to the extension and more definite expression of it.

The results of Bischoff and Voit, conducted through a period of many months, with a dog, either submitted to hunger or fed from time to time on foods containing very different amounts of nitrogenous substance, showed a very variable amount of urea voided, although the animal were kept under equal conditions as to exercise. Still, on the publication of those results in 1860, the authors assumed that although there had been no greater exercise of force manifested in the form of external work, yet when the amount of nitrogenous substance in the food was greater, and the amount of urea voided correspondingly greater, there must have been a corresponding increase in the force exercised in the conduct of the actions proceeding within the body itself in connection with the disposition of the increased amount of nitrogenous substance consumed. When, however, they subsequently found that the amount of urea passed by the animal when subjected to somewhat severe labour was, other things being equal, no greater than when at rest, whilst the carbonic acid evolved was much increased by such exercise, their view was of necessity somewhat modified.

Again, the results of Dr. Edward Smith, which showed great

variation in the amount of urea passed when there was concurrent variation in the amount of nitrogenous substance in the food, and comparatively little variation in the amount of urea voided with great variation in the amount of labour performed, but, on the other hand, great increase in the carbonic acid evolved with increased exercise of force, obviously still further pointed to the correctness of the view that with muscular exertion there was a more marked increased demand for the non-nitrogenous than for the nitrogenous constituents of food.

That this was the necessary conclusion from the results of our own investigations, and also from those of the researches of Bidder and Schmidt, Bischoff, Voit, Pettenkofer, E. Smith, and others, we have frequently maintained. Indeed the view urged in public discussion has been, that all the evidence at command tended to show that by an increased exercise of muscular power there was, with increased requirement for respirable material, probably no increased production and voidance of urea, unless, owing to excess of nitrogenous matter in the food, or a deficiency of available non-nitrogenous substance, or diseased action, the nitrogenous constituent of the fluids or solids of the body were drawn upon in an abnormal degree for the supply of respirable material.

From the facts briefly summarized in the foregoing pages, it will be obvious that the generally accepted views in regard to the adaptation of food, according to its composition, to the various exigencies of the animal body, require modification in other respects than in so far as they relate to the source or developement of muscular power alone. At the same time we hail with much satisfaction the confirmation of the views we have so long maintained on the point in opposition to general authority, which has recently been afforded by the results of the interesting, though limited experiment of Professors Fick and Wislicenus, so ably discussed by them in their paper, and by Professor Frankland in his lecture.

the REPORT of the BRITISH ASSOCIATION for the ADVANCEMENT of SCIENCE for 1866.]
(Read August 24, Section D, and August 27, Section B.)

ON THE

RCES OF THE FAT OF THE ANIMAL BODY.

BY

LAWES, F.R.S., F.C.S., and J. H. GILBERT, Ph.D., F.R.S., F.C.S.*

, Baron Liebig had concluded that the fat of Herbivora must be derived part from the carbo-hydrates of their food, but that it might also be pro- rom nitrogenous compounds. MM. Dumas and Boussingault at first called ion this view; but subsequently the experiments of Dumas and Milne- s with bees, of Persoz with geese, of Boussingault with pigs and ducks, and uthors with pigs, had been held to be quite confirmatory of Liebig's view; ate so far as the formation of fat from the carbo-hydrates was concerned. , however, at the Bath Meeting of the British Association, Dr. Hayden, of read a paper before the Physiological Section, in which, basing his conclu- on certain physiological considerations of a purely qualitative kind, he ex- doubt on the point. In August 1865, again, at a meeting of the Congress ultural Chemists, held at Munich, Professor Voit, from the results of experi- ith dogs fed on flesh, maintained that fat must have been produced from genous constituents of the food, and that these were probably the chief, if only source, of the fat even of Herbivora. In the course of the discussion llowed, Baron Liebig disputed this conclusion; and his son, Hermann von has since written a paper on the subject, in which, illustrating his views by e to experiments with cows, he admits the probability that fat may be from nitrogenous substance, but nevertheless concludes that this is neither nor even the chief source of fat, in the ordinary feeding of Herbivora. uthors agreed with the conclusions of these latter authorities. The data Hermann von Liebig did not, however, afford conclusive evidence on the and they considered that the results of experiments with cows were, in respects, less appropriate for the purposes of the inquiry than those with some imals. They showed, illustrating the various points by reference to expe- of their own, that, compared with either cows, oxen, or sheep, the pig had less proportion of alimentary organs and contents, consumed food of a much haracter, produced a much larger amount of fat both in relation to a given of animal within a given time and to the amount of food consumed, voided less proportion of the solid matter of its food in its solid and liquid excre- d, finally, its increase contained a larger proportion of fat. For these rea- ults obtained with pigs must be much more conclusive as to the sources in l of the fat which they yield than those with either cows, oxen, or sheep. s were exhibited showing the results which had been obtained by the authors rous experiments with pigs; and from these the following main conclusions awn:—

at certainly a large proportion of the fat of the Herbivora fattened for food must be derived from other substances than fatty matter in the food.

at when fattening animals are fed upon their most appropriate food, much stored-up fat must be produced from the carbo-hydrates it supplies.

at nitrogenous substance may also serve as a source of fat, more especially is in excess, and the supply of available non-nitrogenous constituents is ly defective.

* For fuller report, see the Philosophical Magazine for December 1866.

ON THE

SOURCES OF THE FAT OF THE ANIMAL BODY.

IN 1842, Baron Liebig* maintained that the fat of Herbivora must be derived in great part from the carbo-hydrates of their food, but considered that it might also be produced from nitrogenous compounds. MM. Dumas and Boussingault † at first called in question this view: but subsequently the experiments of Dumas and Milne-Edwards ‡ with bees, of Persoz § with geese, of Boussingault ‖ with pigs and ducks, and of ourselves with pigs¶, were held to be quite confirmatory of Liebig's view, at any rate so far as the formation of fat in the animal body from carbo-hydrates was concerned.

In 1864, however, at the Bath Meeting of the British Association for the advancement of Science, Dr. Hayden, of Dublin, read a paper before the Physiological Section, in which, basing his conclusions upon certain physiological considerations of a purely qualitative kind, he argued that fat was not producible in the body from sugar and allied substances, but that both eventually served for the production of carbonic acid and water; and sugar being the most readily oxidized, so saved the combustion, and favoured the storing of fat.

Again, in August 1865, at a Meeting of the Congress of Agricultural Chemists, held in Munich (at which one of the authors was present), Professor Voit**, from the results of experiments with dogs fed on flesh, maintained that fat must have been produced from the nitrogenous constituents of the food, and that these were probably the chief if not the only source of the fat, even of Herbivora. In favour of the probability of this view, Professor Voit refers to the formation of adipocere from nitrogenous substance; but he mainly relies upon the fact that, in experiments by Pettenkofer and himself, in which large quantities of flesh were given to a dog, the whole of the nitrogen reappeared in the form of urea and in the fæces, whilst only a portion of the carbon was recovered in the urine, fæces, and the products of respiration and perspiration, from which it was concluded that some had been retained in the body, and had con-

* Organic Chemistry of Physiology and Pathology, p. 81 *et seq.*
† Balance of Organic Nature, 1844, p. 116 *et seq.*
‡ *Comptes Rendus de l' Académie des Sciences*, vol. xvii. p. 531.
§ *Ann. de Chim. et de Phys.* vol. xiv. p. 408 *et seq.*
‖ *Ann de Chim. et de Phys.* vol. xiv. p. 419 *et seq.*; xviii. p. 444 *et seq.*
¶ "On the Composition of Foods in relation to Respiration and the Feeding of Animals," Report of the British Association for the Advancement of Science for 1852.
** *Versuchs-Stationen Organ.* vol. viii. No. 1, 1866, p. 23.

tributed to the formation of fat. That animals neverth not become fat when fed upon very highly nitrogenou Voit considers sufficiently explained by the greater nu blood-corpuscles, the result of such diet, and the greatly ir activity of oxidation of nitrogenous substance under su ditions; whilst, on the other hand, the accumulation of f fat and carbo-hydrates are supplemented to a liberal nitr diet, he considers to be connected with the much less oxidation of the nitrogenous substance and fatty matter th takes place, rather than attributable to the direct produ fat from the carbo-hydrates.

In the discussion which followed the reading of P Voit's paper, Baron Liebig forcibly called in question P Voit's conclusions, maintaining not only that it was i sible to form conclusions on such a point in regard to He from the results of experiments made with Carnivora, b that direct quantitative results obtained with herbivorous had afforded apparently conclusive evidence in favour opposite view.

Since the Munich Meeting, Hermann von Liebig, Baron Liebig, has written a paper on the subject*, in admitting the probability that fat may be formed from genous substance, he nevertheless concludes that this is its only, nor even its chief source, in the ordinary fee Herbivora.

After referring to the leanness of the South Russian sh who consume very large quantities of dried meat, and rotundity of the peasantry, especially the women, in where bread and fruits constitute the chief articles of f von Liebig proceeds to illustrate the formation of fat fro nitrogenous constituents of food by our domestic Herbi the calculation of the results of numerous experiment with cows in 1857, by Knop, Arendt, and Behr, in wh details as to food, live-weight, and quantity and composi milk, were accurately recorded. According to the mode culation adopted, it appeared that, after deducting fr amount of nitrogenous substance taken in the food, that es to be required by the system for other purposes, th generally little or none remaining for the production of f his calculations, however, H. von Liebig, besides takin account the probable amount of nitrogenous substance st in increase with gain of weight, or set at liberty when th loss of weight, as the case might be, deducted from the of nitrogenous substance given in the food, not only quired for the production of the caseine of the milk, b

* *Versuchs-Stationen Organ.* vol. viii. No. 3, 1866.

the whole of that estimated to be required for the mere sustenance of the animal (according to its weight), independently of gain or loss, or milk produced.

It is obvious, however, as pointed out by Voit, and as afterwards admitted by H. von Liebig, that if nitrogenous substance may break up into urea and fat (with other products), the amount estimated to be required for the mere sustenance of the body should not be considered inadmissible for the formation of fat as one of its products, and therefore should not be deducted (with that appropriated for the production of increase and of the caseine of the milk) from the amount supplied in the food in estimating whether or not it provided sufficient for the formation of the fat known or calculated to be produced.

H. von Liebig states that he selected experiments with cows as the basis of his illustrations, considering that, when in a normal state, the change in the solid substance of the body of the animal was comparatively small, if not indeed immaterial, and that the fixed products of the food, beyond what might be required for the mere maintenance of the body, were accumulated and easily estimated in the milk collected; whilst he considered, on the other hand, that the point in question could not be settled by reference to results relating to fattening animals, without the aid of an apparatus for the determination of the products of respiration and perspiration. We believe, however, that with a proper selection of fattening animals it may be satisfactorily illustrated without the aid of any such apparatus; and it is the object of this paper briefly to discuss the question of the sources of the fat of the animal body by reference to the results of experiments with such animals.

As already intimated, the objections of Dr. Hayden to the supposition that fat is formed from the carbo-hydrates of the food, were based upon physiological considerations of a qualitative, but not at all of a quantitative kind. Voit's argument was, on the other hand, founded upon strictly quantitative results, obtained, however, under conditions as to choice of animal and of food, in which the formation of fat, if it took place at all, must of necessity be attributed to the nitrogenous constituents consumed. H. von Liebig also relied upon quantitative results as the basis of his illustrations; but those selected, when properly considered, afforded, to say the most, only negative evidence on the point.

The question arises—What description of animal is likely to yield the most direct and conclusive evidence as to the source of the fat stored up in its body? Obviously the one which is fed more especially with a view to the production of fat, which consumes in its most appropriate fattening food a relatively large proportion of carbo-hydrates, and which yields a

large proportion of fat, both in relation to the weight of animal within a given time, and to the amount of food consumed. The following Table (I.), which summarizes the results of a great many direct experiments of our own *, will show that of the ox, the sheep, and the pig—the most important of the animals fed and slaughtered as human food—the last pre-eminently supplies the required conditions.

TABLE I.—Comparative fattening-qualities of different animals.

	Oxen.	Sheep.	Pigs.
Relation of parts in 100 live-weight.			
Average of	16	249	59
Stomach and contents	11·6	7·5	1·3
Intestines and contents	2·7	3·6	6·2
	14·3	11·1	7·5
Heart, aorta, lungs, windpipe, liver, gall-bladder and contents, pancreas, spleen, and blood	7·0	7·3	6·4
Per 100 live-weight.			
Dry substance consumed in food per week	12·5	16·0	27·0
Increase yielded per week	1·13	1·76	6·43
Per 100 dry substance of food.			
Total dry substance in increase	6·2	8·0	17·6
Fat in increase	5·2	7·0	15·7
Total dry substance in urine and fæces	36·5	31·9	16·7
Average fat per cent.			
In lean condition	16·0	18·0	22·0
In fat condition	30·0	35·0	44·0
In increase whilst fattening	60·0	65·0	70·0

Looking first to the comparative structure of the animals, so far as it may be considered characteristic or indicative of the description of the food, it is seen that, of stomach and contents, the ruminant ox has a much larger proportion than the ruminant sheep, and the ruminant sheep in its turn much more than the non-ruminating pig. Consistently with these facts we find that the ox consumes in its food a much larger proportion of

* For the data upon which most of the average results given in the Table are founded, see "Experimental Inquiry into the Composition of some of the Animals fed and slaughtered as Human Food," Phil. Trans. Part II. 1859. In the estimates given "per 100 live-weight" and "per 100 dry substance of food," it is assumed that the oxen and sheep are liberally fed on oil-cake, clover-chaff, and roots, and the pigs on barley-meal alone; with different foods the results will, of course, be different.

only slowly digestible, or indigestible, cellulose than the sheep, and the sheep again very much more than the pig. The usual food of oxen and sheep, consisting as it does in large proportion of unripened or imperfectly ripened vegetable matter, is, in fact, essentially crude, containing not only a considerable amount of defectively elaborated and probably unassimilable nitrogenous substance, but also a large proportion of comparatively indigestible non-nitrogenous matter. Accordingly, complexity and great capacity of stomach, and slow progress of the food through the organ, are characteristics of the structure and digestive process of the animals.

Of intestines and contents, on the other hand, the ox has a less proportion than the sheep, and the sheep considerably less than the pig.

In fact, the relatively very small proportion of stomach and contents, and relatively very large proportion of intestines and contents in the pig are very striking. But when we consider that his most appropriate fattening food consists of ripened seeds and highly starchy roots, containing little indigestible woody fibre, and their non-nitrogenous constituents almost wholly in the form of starch, the primary change of which is known to take place almost throughout the length of the intestinal canal, the reason of the relatively small proportion of stomach, and large proportion of intestines, seems to be at once apparent.

Passing from a consideration of the receptacles and, so to speak, first laboratories of the food, we will only remark, in reference to the remaining results given in the upper portion of the Table, that, of what may be called the further elaborating organs of the body, and their fluids—the heart, liver, lungs, blood, &c. —the proportion, taken in the aggregate, is strikingly similar in the three descriptions of animal.

The second division of the Table shows that, notwithstanding its much larger proportion of stomach and contents, the ox consumes, for a given live-weight within a given time, only about three-fourths as much dry substance of the food as the sheep, and less than half as much as the pig with its very small proportion of stomach and contents. The ox gives, too, in proportion to a given live-weight within a given time, much less increase than the sheep, and only from one-fifth to one-sixth as much as the pig.

Reckoned in proportion to a given amount of dry substance of food consumed, the ox gives less, both of total dry substance in increase and of fat in increase, than the sheep, and only about one-third as much of either as the pig, whilst the ox voids of dry substance in fæces and urine the largest proportion, the sheep somewhat less, and the pig little more than half as much as the sheep, and less than half as much as the ox.

Lastly, the proportion of fat, whether reckoned in relation to the total weight of the body, or to the weight of the increase whilst fattening, is greater in the sheep than in the ox, and greater still in the pig.

Whilst referring to the connexion between the weight and capacity of the stomach and the character of the food, it will not be without interest to call attention to the gradation in the proportion from the ox to the sheep, from the sheep to the pig, and from the pig to man. Below is given the approximate average proportion of stomach, by weight, in 100 live-weight of each.

Oxen.	Sheep.	Pigs.	Man.
3·19	2·44	0·88	0·38

Without assuming that relative weight represents with numerical exactitude relative capacity or size, we nevertheless cannot doubt that these figures have a very obvious significance. Thus, the ox consumes the largest proportion of difficultly digestible or indigestible woody-fibre, the sheep less, the pig scarcely any, but a much larger proportion of comparatively easily digestible starch, whilst man, within certain limits, the better he is fed the less does the non-nitrogenous portion of his food consist of starch, and the more of the much more highly concentrated alimentary substance fat, produced for him from much less concentrated vegetable food-materials by the animals which he feeds for his own consumption.

From the facts which have been briefly stated, it will be obvious that, of the most important animals which we feed for human food, the pig offers many advantages as a subject for the consideration of the source in the food of the fat which he yields. Thus, for a given live-weight he comprises a comparatively small proportion of alimentary organs and contents, and he consumes a large proportion of food, and yields a large proportion both of total increase and of fat, within a given time; his food is, as such, of a high character, yielding, compared with that of oxen or sheep, for a given weight of it much more total increase, much more fat, and much less excreted and necessarily effete matter; whilst his proportion of fat is the greatest, both in a given live-weight and in his increase whilst fattening. It results that changes in his live-weight are in a much less degree likely to be influenced by variation in the amount of the contents of the stomach and intestines, and are therefore much more direct indications of real increase of the substance of the body, and hence that there is much less probable range of error in calculating the amount and composition of the increase in live-weight in relation to the amount and composition of the food consumed.

In fact, from the very opposite characters of the ruminant in these respects, it is very much less appropriate for the purpose of estimating the sources in its food of the fat of its body. It is true, that there is the advantage with the cow, that that important product of the food—the milk—is collected externally to the body, and hence its amount and composition can be easily determined; but the changes of weight of the animal itself, though comparatively small, are due to a greater variety of circumstances, and can, therefore, with less of certainty be properly interpreted than even in the case of either the ox or the sheep. Indeed, when experiments are conducted with cows or oxen, or even with sheep, for periods of a few weeks only, the variation in live-weight may in very great proportion be due to variation in the contents of the alimentary organs merely.

The selection and calculation of results brought to view in Table II. (p. 8) will show that, when experiments are conducted with pigs fed on good fattening food, for periods of not less than eight or ten weeks, the amounts, both of total increase and of fat stored up, are so great in proportion both to the original weight of the animal and to the food consumed, that the data so obtained may be safely relied upon as a means of estimating, with sufficient accuracy for the purposes of the present discussion, from what constituent or constituents of the food the fat of the animals has been derived.

Experiment 1.—In this experiment two pigs of the same litter, of equal weight, and, as far as could be judged, of similar character, were selected. One was killed at once, and the amount of total dry or solid matter, nitrogenous substance, fat, and mineral matter, in its body, determined. The other was then fed for a period of 10 weeks on a good mixed food, containing, however, a more than usually high proportion of nitrogenous substance. It was then weighed and killed, and its composition was determined as in the case of the other animal. The results so obtained supplied an important portion of the data requisite for the calculation of the composition of the increase in the other cases *. The food consisted of a mixture of bean-meal, lentil-meal, and bran, each one part, and barley-meal three parts, given *ad libitum*.

* For further details relating to this and the other experiments, we must refer to our former papers, as follows:—"On the Composition of Foods in relation to Respiration and the Feeding of Animals" Report of the British Association for the Advancement of Science for 1852. "Agricultural Chemistry: Pig Feeding," Journ. Roy. Ag. Soc. Eng. vol. xiv. part 2, 1853. "On the Equivalency of Starch and Sugar in Food," Report of the British Association for 1854. "Experimental Inquiry into the Composition of some of the Animals Fed and Slaughtered as Human Food," Phil. Trans. part 2, 1859.

TABLE II.—Relation of the total Fat in the increase, to the ready-formed fatty matter in the Food, and of the Carbon in the Fat produced within the body, to that in the nitrogenous substance consumed, in experiments with Fattening Pigs.

Experiments		1.	2.	3.	4.	5.	6.	7.	8.	9.
Conditions, and actual results of experiment.										
Number of animals		1	3	3	3	3	3	3	3	3
Duration of Experiment (weeks)		10	8	8	8	8	10	10	10	10
Non-nitrogenous substance to one nitrogenous substance in food		3·6	3·3	2·0	6·6	6·0	4·1	4.1	4·7	3·9
Original live-weight (lbs.)		103	429	440	431	449	286	285	281	292
Final live-weight (lbs.)		191	685	743	652	739	533	533	553	604
Increase in live-weight (lbs.)		88	256	303	221	291	247	248	272	312
Increase on 100 original weight		85·4	59·7	68·9	51·3	64·9	86·4	87·0	96·8	106·8
Increase per 100 lbs. live-weight, per week		6·0	5·7	6·4	5·1	6·1	6·0	6·1	6·6	7·0
Calculated for 100 increase in live-weight.										
Fat	Stored up in increase	63·1	73·9	69·6	79·0	71·2	64·1	63·9	62·0	59·9
	Ready-formed in food	15·6	20·4	11·2	26·3	12·4	7·9	7·9	7·3	6·6
	Not ready-formed (produced)	47·5	53·5	58·4	52·7	58·8	56·2	56·0	54·7	53·3
Nitrogenous-substance.	Consumed in food	100·0	107·0	138·0	57·0	64·0	81·0	81·0	74·0	82·0
	Stored up in increase	7·8	6·1	6·7	5·3	6·5	7·5	7·6	8·0	8·2
	Not stored up (available for fat, &c.)	92·2	100·9	131·3	51·7	57·5	73·5	73·4	66·0	73·8
Calculated for 100 carbon in estimated "produced" fat.										
Carbon	In "produced" fat	36·6	41·2	45·0	40·6	45·3	43·3	43·1	42·1	41·0
	In "available" nitrogenous substance *minus* urea	44·0	48·1	62·6	24·7	27·4	35·1	35·0	21·5	35·2
	Difference	+7·4	+6·9	+17·6	15·9	17·9	8·2	8·1	10·6	5·8

Experiments 2 & 3.—In both these experiments the proortion of nitrogenous substance in the food was very large; ne relation of non-nitrogenous to one of nitrogenous substance eing in Exp. 2 little more than half, and in Exp. 3 little more than ne-third as much as is usual in the recognized good fattening ood of the animal. In Exp. 2 the food consisted of bran, ean and lentil-meal, and Indian-meal, each given separately, nd *ad libitum;* and in Exp. 3 of an equal mixture of bean and entil-meal only, given *ad libitum.*

Experiments 4 & 5.—In Exp. 4 the food consisted of Inlian meal only, and in Exp. 5 of barley-meal only, in each case given *ad libitum.* Barley-meal is undoubtedly the most approved taple fattening food of the pig; and the result was that, in oth these experiments, the proportion of non-nitrogenous to nitrogenous substance in the food was very nearly, though ather higher than, the average in that which is recognized as he most appropriate fattening food of the animal.

Experiments 6, 7, 8, & 9.—The peculiarity of this series was, that the food contained less ready-formed fat than was the ase in either of the other experiments, and that a large proportion of the non-nitrogenous substance supplied was in the form of either pure starch, pure sugar, or both. In Exps. 6, 7 & 8, a fixed quantity of lentil-meal and bran (averaging nearly 3¼ lbs. lentil-meal and about 9 ounces bran) was given per head per day, and, in addition, in Exp. 6 sugar, in Exp. 7 starch, and in Exp. 8 sugar and starch, each separately, *ad libitum.* In Exp. 9 lentil-meal, bran, sugar, and starch were each given separately, *ad libitum.*

The figures given in the Table show that the increase in weight was in no case less than 50, and in several nearly, and n one more than 100 per cent., upon the original weight of he animals; the amounts ranging from 51·3 to 68·9 per cent. when the experiment extended over eight, and from 85·4 to 06·8 per cent. when it extended over ten weeks.

The determined or estimated amount of fat stored up in the ncrease was also in all cases very large, amounting to 63 per ent. of the total increase in Exp. 1, in which it was experientally determined, and calculated to be even more than this n several of the other cases. The tendency to error in the calulations would, however, be to give the proportion too low in xps. 6, 7, 8 & 9, which were conducted over a period of n weeks, and in which the proportion of increase upon the riginal weight was very high, and to give it too high in Exps. 3, 4 & 5, conducted only over eight weeks, but more espeally in Exps. 2 & 4, in which the proportion of increase pon the original weight was comparatively small. The range the probable error of calculation here indicated is, however, ot such as in any degree to throw doubt upon the validity of

any conclusions which will be drawn from the indications of the figures as they stand.

It is seen that, of the determined or estimated total fat stored up in the increase, the proportion which could possibly have been derived from the ready-formed fat of the food, even supposing the whole of that supplied had been assimilated, was so small as to leave no doubt whatever that a very large proportion of the stored-up fat must have been produced from other constituents than the ready-formed fatty matter of the food. According to the figures given in the Table, the proportion of fat which must have been so produced, ranged from about two-thirds to about eight-ninths of the total amount stored up.

Assuming it, then, to be established beyond doubt, that there was a very large formation of fat within the body from other constituents than the fatty matter of the food, the question is arise, whether this large amount of produced fat could possibly have been derived from the nitrogenous constituents of the food? or whether it must of necessity have had its source, in greater or less proportion, in the carbo-hydrates at the same time supplied? The results adduced afford conclusive evidence on this point also.

The figures show that, after deducting from the total amount of nitrogenous substance consumed for the production of 100 lbs. of increase in live-weight, the small amount estimated to be stored up in the increase, there remains a very large proportion available, it may be, for the production of fat with other products.

If we next compare the amount of carbon in the estimated *produced* fat, with the amount contained in the nitrogenous substance of the food not stored up as increase, *minus* that contained in the urea which would be one of the final products of the breaking up of this nitrogenous substance (or its equivalent given off), the result shows in some cases an excess, and in others a deficiency, of carbon possibly available from the nitrogenous constituents of the food, compared with that required for the formation of the fat estimated to be derived from other constituents than the ready-formed fat in the food.

Reckoned to the standard of 100 carbon in the estimated produced fat, it is seen, as shown in the two bottom lines of the Table, that in Exps. 1, 2 & 3, in which the proportion of non-nitrogenous to nitrogenous substance in the food was (especially in Exp. 3) considerably less than in such food as experience has shown to be the most appropriate in the fattening of the pig—that is to say, in which the nitrogenous substance was in considerable excess over the amount and proportion usually supplied—there was, according to the calculation, more than sufficient carbon possibly available from the nitrogenous substance of the food for the formation of the fat estimated to be produced.

In Exps. 4 & 5, however, in which the relation of the non-itrogenous to the nitrogenous substance in the food was much ıore nearly that in the usual food of the well-fed fattening pig, is reckoned that there was about 40 per cent. of the carbon f the produced fat which could not possibly have been supplied om the nitrogenous constituents of the food.

In the other experiments (Nos. 6, 7, 8 & 9), in which ;ain the proportion of the non-nitrogenous to the nitrogenous nstituents of the food was lower than usual (though not so ach so as in Exps. 1, 2 & 3)—in which, in fact, the nitro-nous constituents were in excess—there was still a consider-le proportion of the carbon of the produced fat which the trogenous constituents of the food could not possibly have pplied.

It is hardly necessary to point out that, according to the ode of illustration we have adopted, the figures show, not only e utmost proportion of the carbon of the stored-up fat which uld possibly have had its source in the nitrogenous substance the food, but even notably more than could possibly have en so derived. Thus, to say nothing of other considerations, has been assumed for simplicity of illustration, and granted r the sake of argument, that the whole of the ready-formed tty matter of the food contributed to the fat stored up, that ıe whole of the nitrogenous substance of the food not stored up increase would be perfectly digested and become available for e purposes of the system, and that in the breaking up of the trogenous substance for the formation of fat no other carbon-mpounds than fat and urea would be produced. It is ob-ous, however, that these assumptions are in part improbable, d in part quite inadmissible, and that the tendency of each them is to show too large a proportion of the produced fat have been possibly derived from the nitrogenous constituents the food.

The amount of fat necessarily derived from other sources ıan the nitrogenous constituents of the food must therefore e greater than our mode of estimate can indicate; and it is bvious, from the figures given in the Table, that the less the xcess of nitrogenous substance in the food, the greater was he proportion of produced fat which must necessarily have had ts source in the carbo-hydrates of the food, and that, at any rate n those cases in which the proportion of non-nitrogenous to iitrogenous constituents supplied was the more nearly that ccurring in the admittedly most appropriate fattening food of he animal, the proportion of the fat which must necessarily ave been derived from the carbo-hydrates was very large, even llowing all that was possible to have been produced from the iitrogenous substance of the food.

That, nevertheless, fat may be produced in the animal body

at the expense of nitrogenous substance, in greater or less degree according to the character of the animal and of the food, not only chemical and physiological considerations, but direct experimental evidence would lead us to conclude. Indeed we have, in former papers already referred to, called attention to the fact that the results of our experiments with fattening animals, when carefully considered, afford evidence in favour of such a conclusion. To discuss the point satisfactorily on the present occasion, by the aid of figures, would, however, unduly extend the limits of our paper.

But, as indicating the bearing of the results referred to, it may be stated, in passing, that in numerous cases, otherwise comparable, but in which the amount and proportion of the nitrogenous constituents consumed varied very greatly, the results clearly showed that, neither the amount of food consumed, nor the amount of increase in live-weight produced, bore any direct relation to the amount of nitrogenous substance supplied. On the other hand, both the amount of food consumed, and the amount of increase produced, bore a very close relation to the supply of digestible non-nitrogenous constituents, and even a closer relation still to the amount of total digestible dry organic substance (that is, nitrogenous and non-nitrogenous taken together); whilst, so far as could be judged from careful observation, the proportion of nitrogenous to non-nitrogenous substance (fat) in the increase did not vary in anything like a corresponding degree with the variation in the proportion of the nitrogenous and non-nitrogenous constituents in the food. The animals consuming excessive amounts of nitrogenous substance did, indeed, show a greater tendency to increase in frame and flesh; but they nevertheless became fat. It would appear, that the excess of nitrogenous substance had acted vicariously in defect of a greater supply of the non-nitrogenous constituents, contributing material not only to meet the respiratory exigencies of the animal, but also for the production of fat.

The main conclusions in regard to the sources of the fat of the animal body to which the evidence adduced has led, may be briefly stated as follows:—

1. That certainly a large proportion of the fat of the Herbivora fattened for human food must be derived from other substances than fatty matter in the food.

2. That when fattening animals are fed upon their most appropriate food, much of their stored-up fat must be produced from the carbo-hydrates it supplies.

3. That nitrogenous substance may also serve as a source of fat, more especially when it is in excess and the supply of available non-nitrogenous constituents is relatively defective.

EWAGE UTILISATION.

BY

DR. J. H. GILBERT, F.R.S., &c.

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SEWAGE UTILISATION.[1]

Dr. J. H. GILBERT observed, through the Secretary, that there could be no doubt whatever that the interception or dry processes referred to by Mr. Redgrave were an immense improvement upon the old midden-pit or common privy systems; but no such plan could be accepted as a solution of the sewage difficulty. About four-fifths, or more, of the manurial value of human excretal matters were due to the urine. It was a desideratum with all such systems to exclude as much of the urine as possible, and the complete separation of the liquid from the solid dejections had been recommended. Of course, this would much reduce the value of any dry manure so produced, which was already so low as not to be worth more than its carriage beyond the immediate locality. Without such special separation, at the outside about one-third of the urine would be collected with the fæces. Under any such dry system there was, therefore, from two-thirds to the whole of the urine, besides all wash and other house drainage, still to be dealt with; and if the liquid had to go into a stream which served as the water-supply for other populations, sooner or later purification would be enforced. Passing the liquid through land was not only the best mode of purification, but promised the greatest return for the constituents it contained—whether profit to the towns, depended on many local circumstances. Then as to precipitation methods. There could be no doubt that any one of those referred to by Mr. Shelford would be a vast improvement upon doing nothing whatever with sewage that had to be turned into an open stream. No such plan was, however, likely to collect more, and would generally

[1] These remarks were communicated to the Secretary of the Institution of Civil Engineers in reference to the Papers by Mr. Redgrave "On Sewage Interception Systems, or Dry Sewage Processes," and by Mr. Shelford "On the Treatment of Sewage by Precipitation," read March 28, 1876.

ɔollect less, than one-fourth of the nitrogen of the sewage in the solid manure. This one-fourth was, moreover, the least active and east valuable part. These plans also, as a rule, carried down the phosphates, but in a precipitated, not in a soluble, form; and in more than one scheme soluble phosphate had been used, and was converted from this more valuable into the less valuable precipitated condition. The estimate of the value of the nitrogen (reckoned as ammonia) in such a manure, containing only from 1 to 2 per cent. of it, at the same rate as when provided in guano containing about 12 per cent., and in a much more soluble condition, was entirely fallacious; as also was the valuation of precipitated phosphate at 3s. 3*d.* per unit. Would, then, such precipitated manures pay for heir manufacture as such? He thought not. If the process were adopted mainly as a means of purification, what was the result? About three-fourths of the nitrogen of the sewage would remain n the liquid. This would exist, in the main, not as nitrates, but as ammonia and soluble organic compounds. This liquid, with all other house drainage, remained to be dealt with. He did not think that such a liquid would eventually be allowed to run into a water-supply stream. Passing it through the land would best purify it, and would yield the largest return. If the sewage were employed for irrigation, the less taken out of it, beyond the sludge, before use, the better; and if the phosphates were removed, they should be returned either to the sewage or to the land irrigated. In fact, where irrigation was to be eventually adopted, the less effective the precipitation process the better; indeed, the exclusion of the natural sludge was all that was desirable. He was by no means unconscious of the many difficulties involved in the general adoption of sewage irrigation, but he believed if rivers were to be kept from pollution, it would eventually have to be adopted, wherever practicable, before the liquid was discharged into them.

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ON SOME POINTS IN CONNECTION WITH ANIMAL NUTRITION.

BEING AN ADDRESS DELIVERED AT SOUTH KENSINGTON, IN THE BIOLOGICAL SECTION OF THE SCIENCE CONFERENCES, MAY 26, 1876.

BY DR. J. H. GILBERT, F.R.S., F.L.S., F.C.S.

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On Some Points in connection with Animal Nutrition.

By Dr. J. H. Gilbert, F.R.S., F.L.S., F.C.S.

A few days ago Professor M. Foster wrote to me to say that he intended to bring the subject of nutrition forward on this occasion, and asked me if I would take part in the discussion afterwards; and as he and I had had a good deal of correspondence and conversation some little time since about the important question of the sources of the fat of the animal body, I concluded it was probably to that subject he wished me to devote my attention. At any rate, I looked up hurriedly the materials which Mr. Lawes and myself have collected in relation to that subject, and some allied points, and propose, with your permission, to lay the facts before you shortly, although Professor Foster has not given you his paper.

Thirty-five years ago, or more, I believe the view generally accepted was, that the carnivora found the fat which existed in their bodies ready-formed in the herbivorous animals they consumed, and that the herbivora in their turn found all the fat of their bodies ready stored up in the plants they consumed. About that time Liebig, in reviewing the composition of vegetable food, came to the conclusion that this was simply impossible, taking into consideration the amount of fat which was stored up by many animals in proportion to the known quantities in the food. He put forward the view that the carbohydrates of the food—starch, sugar, and so on—were important sources of the fat of the herbivora. For a short time this view was opposed, but only for a short time, by Dumas and Boussingault, and some other experimenters in France, though they afterwards accepted it.

The investigations of Mr. Lawes and myself, it must be borne in mind, have always had an agricultural object, so that if they were not conducted exactly in the way which the physiologist will say they might have been, it has been because we had not the same object before us, that is a purely physiological one. Very soon our own experiments led us to believe that Liebig was right in his conclusion on this point, but that he must be wrong on some other points in relation to the feeding of animals which he so ably discussed. We found it was pretty certain, from the consideration of the feeding experiments, that some of the fat must have the source which he assumed.

On the other hand, he assumed that the value of food to the animal was measured by the amount of nitrogen which it contained; that is to say, he maintained that, in the formation of meat, in the formation of milk, and in the exercise of force, the measure of the value of the food required, for these purposes, was the amount of nitrogen it contained; and in the case of the exercise of force, the amount of urea which was eliminated. We found, however, that we could give twice or three times the quantity of nitrogen within a given time to one animal as to another, both at rest, and that the amount of nitrogen eliminated in urea was almost proportional to the amount of nitrogen in the food, and had no direct connection with the amount of force exercised.

The question of which of the constituents in the food, were of the most importance for the exercise of force, and for the making of fat, remained in this condition until the experiments instituted in Munich, about 16 or 17 years ago, with Pettenkofer's beautifully contrived respiration apparatus, a model and drawings of modifications of which are in the next room. I am glad that after very much trouble on my part to get such an apparatus brought to this Exhibition, and entirely failing, it has after all been sent by some one. It consists of a chamber in which an animal can be put, and by a water wheel, or by some other power, the air is gently aspirated through the apparatus, then it passes through guages, and through solutions, which absorb the carbonic acid, &c., and so the amount of air passing is gauged, and the products of respiration are determined. It is not the apparatus itself, but the results which it has brought out, which I wish to refer to on this occasion. In 1860, Bischoff and Voit published their first results. They kept a dog for many months without change as to movement, without giving it any special exercise, but varied its food immensely, and they found the urea eliminated was almost in proportion to the amount of nitrogen taken in the food. But inasmuch as the then existing view required this to be connected in some way with the exercise of force, they explained that so much more force was exercised in the actions within the body in dealing with the increased amount of nitrogenous substance consumed; so that after all the amount of the urea eliminated was a measure of the exercise of force, although it was in these internal actions, and not in the voluntary exercise of muscular power. I was in Germany at the time that book came out, and went to Munich, hoping to see these gentlemen on the subject. In conversation with Professor Voit, I ventured to call in question the

nclusion at which they had arrived, and I think he considered I ıs entirely in error. But a few years afterwards it was found by hers also that the amount of urea eliminated had no direct connec- n with the amount of force exercised, and that what is the most onounced when there is an increased exercise of force, is an in- eased elimination of carbonic acid by the lungs. I believe there now no doubt about that matter. Messrs. Fick and Wislicenus, r. Frankland, and Dr. E. Smith, brought that prominently forward, d I believe it is now accepted that the elimination of urea is no easure of the muscular force exerted within the body.

After putting forward these views, Messrs. Bischoff and Voit put eir dog into a kind of tread-wheel, and they found that the amount urea eliminated was not in proportion to the exercise of force, but e amount of carbonic acid was so, and eventually they themselves mitted the truth of this.

Then came the question of the sources of animal fat. On this int, again, Voit has worked almost exclusively with the dog, which a carnivorous, or, at most, an omnivorous animal.. He has found, hich I do not wish to call in question, that in the case of the car- vora, and in some cases of the herbivora, the fat may be formed from e nitrogenous substance of the food. But from the results obtained ith this carnivorous animal he has come to the conclusion, that not only such cases, but in all, the fat formed within the animal is derived om the albuminous substance of the food or of the body. I have oughly noted a few of the experiments of Voit, which I believe are the trongest or most conclusive for his view of the question. He found hat when a dog was fed on starch or sugar alone, or with albumin, r with fat and albumin, the carbon stored up, that is to say, the arbon which was not eliminated in any way from the body, was never ore than that in the fat of the food, *plus* that in the albumin which as broken up, as indicated by the amount of urea eliminated. He ncluded that this was a proof that fat was not formed from the rbohydrates. In another case, which perhaps was stronger, he fed e dog with starch and a little fat, but no albumin whatever, and the rbon stored up was equal to that of the fat in the food, *plus* that due the oxidation of albuminous tissue, and when he gave more starch this food the amount of carbon stored up was reduced ; that is to say, argues that the carbohydrates in this case protected the albumin of e body from disintegration, and did not in any way serve for the oduction of fat ; and that there would have been a greater storing

up of carbon if this additional starch which he gave to the anim had been the source of the fat. He also argued, from a number experiments, that starch and sugar are quite oxidised in the bod yielding carbonic acid, &c., within twenty-four hours. He maintai that the same must occur with herbivora as with carnivora. Th carnivora are found absolutely to digest vegetable food, and take into their system as an herbivorous animal; and he argues that, establish a different source of fat, it must be shewn by experiment th fat is formed in excess of that in the food, *plus* that which can formed from the oxidated albumin. Now this, I think, I shall be ab to show you we have done. We have not accepted the challenge the way of making new experiments for the purpose, but I think have old experiments which are perfectly conclusive, and do me exactly the requirement which Voit says is essential to disprove t view which he maintains with regard to the herbivora.

But before entering on our own experiments, I will just say what h happened in answer to the challenge in Germany. Weiske and Wi conceived, as I shall be able to show afterwards was a very right thi to conceive, that the pig was the very best animal to experiment on this purpose. He is certainly *the* fat-maker of all the animals that feed; and there are other reasons why he is the best of all others experiment upon in this particular. They had, from a theoreti point of view, a very good conception of what was necessary. Th took four pigs, slaughtered two of them, and determined the fat a other constituents in those animals. Then they fed one on food ve poor in nitrogenous substance, and one on food exceedingly rich nitrogenous substance. It happened that the pig fed on food very ri in nitrogen had so much that it became unwell, and that experime failed entirely. With regard to the one fed on food poor in nitrog the food was so poor that the experiment took too long a time; fact, too much food was passed through the body in proportion to t increase produced; and when eventually they slaughtered that anim and analysed it, so much nitrogen had passed through the body du ing the time, that they found the whole of the fat that had been form might be derived from the nitrogenous substance consumed. Weis and Wildt did not conclude therefrom that it was established that could only be produced from the nitrogenous substance, but th admit that the experiment was not conclusive.

In the experiments of Mr. Lawes and myself we have used a gre many animals, and we have brought our results into calculatio

although the experiments were not at the time arranged with the special view of determining this question. The table shows some results of experiments with sixteen oxen, 249 sheep, and fifty-nine pigs. You will see that the proportion of stomachs and contents in the body is 11·6 per cent. with the oxen, 7·5 with sheep, whilst it is only 1·3 in the pig. The intestines and contents, on the other hand, shew in oxen only 2·7, in sheep 3·6, and in the pig 6·2 per cent.; with it, therefore, very much more than with either of the ruminant animals. We know that the character of the food is such in the case of the ruminants that they must pass an enormous quantity of very crude stuff through their bodies, and must elaborate it first in one stomach and then in another, and the result is they have not only a very large capacity of stomach, but also a very large proportion of contents in relation to the whole body. In the case of the pig, on the other hand, the stomach is exceedingly small; the natural food of the pig is starchy seeds or roots (which are the food of man also), it contains exceedingly little necessarily effete matter, their stomachs have comparatively manageable stuff to deal with, and they have a very small stomach, while on the other hand their intestines are very large. It is known that the transformation of the starch goes on almost throughout the intestinal canal, so that we can easily understand how it is that with such starchy food these animals have an enormous amount of intestines compared with either oxen or sheep. If we look at the proportion in the live weight of the, so to speak, further elaborating organs the heart, the liver, the lungs, the pancreas, and so on, their percentage by weight in the bodies of the three descriptions of animals is almost identical.

Now, for 100 lbs. of live weight the amount of dry substance consumed per week was 12·5 byoxen, 16 by sheep, and 27 by pigs; that is: 100 lbs. live weight of pig will consume much more dry substance of food, and, as I have stated, that food is of a more highly nutritive kind, and more easily digested, than that of oxen or sheep. Again, the increase per week was only 1·13 per cent. on the live weight of oxen, 1·76 of sheep, and 6·43 of pigs. So that the proportion of the increase to the weight of the body is much the greatest with the pig. Then, if we take the facts in relation to the amount of the food, for 100 lbs. of dry substance of food, the ox will give in increase only 5·2 of fat, the sheep 7, and the pig 15·7. Suffice it to say, that there is less effete matter in the food of the pig, and therefore its live weight and its increase indicate more nearly the real increase of the body, and

not the fluctuating matters in the alimentary canal. Its food is of a higher character, so that a larger proportion of it is stored up. That which passes through the system is more completely used, and the amount of fat which is produced is also very much higher. Therefore, I say the pig is by far the best animal to experiment upon for this purpose.

Whilst on this subject I may refer to a portion of the table which vegetarians will perhaps not be much pleased to see. If we are to judge that the size of the stomach indicates to some extent the character of the food, its crudeness or concentration, as no doubt is the case with the other animals, and if we compare oxen, sheep, pigs, and man, we find the proportion of stomach by weight per cent. is, approximately, in oxen 3·2, in sheep 2·44, in pigs about 0·88, and in man only 0·38; so that going from one animal to the other you should have more concentrated and more digestible food in the case of man, than of the pig; and you have animal food as well as starchy seeds, roots, &c.; and the indication is, I think, that man was not made to consume potatoes and cabbages by the bushel.

The next point is as to the indications of merely practical results. Without going into the chemistry of the subject, or discussing whether the food of the animal does contain enough or not enough of nitrogenous substances to yield all the fat produced, I will call attention to some results which will indicate the general relations of the food to the necessities of the body. On the coloured diagram you have the results of thirty separate experiments on pigs. The plan was this: we gave to a certain set a fixed amount of highly nitrogenous food, and let them take whatever they liked of less nitrogenous food. To another set we gave a fixed amount of food low in nitrogen and rich in starch and such matters, and let them make up whatever they wanted with highly nitrogenous food. So we rang the changes in a great many more cases than are here represented, but in this way it will be seen that the animal fixed its own diet according to the necessities of the case; and the question is, was it the nitrogenous substances, was it the non-nitrogenous substances, or was it the total dry substance, nitrogenous and non-nitrogenous together, which guided the amount consumed by a given live weight within a given time, or rather guided — for these were fattening animals — the amount of increase which was produced? The lowest amount of nitrogenous substances consumed by 100 lbs. of live weight of pig per week in any one experiment being taken as 100, in some cases 300 were taken, and

nost more than 200. In the same way the lowest amount of non-ogenous substance being taken as 100, in no case was nearly as :h as 200 consumed, and the average was about 140 parts. When come to the total dry substance, including both nitrogenous and -nitrogenous, we find that the quantities ranged more closely ether; that is to say, the total digestible organic substance seems to e been the measure of what was required, and that the nitrogenous ht possibly act for the non-nitrogenous substances if there were enough of them. But it is quite clear that the measure was either non-nitrogenous substances or the total organic substances—cer-ly not the nitrogenous substances. Then the question arose, ther the same thing would hold in relation to the amount of ease in the weight of animal produced. It was always assumed, ink, until these experiments of Mr. Lawes and myself, that when nals were not fed on highly nitrogenous food the amount they ed up was comparatively small. These experiments show the unt of these three classes of constituents consumed in produc- 100 pounds increase of live weight in the different cases. 100 nds being the lowest amount of nitrogenous substance required, was the highest, the animal fixing his own diet, and in many s it was over 200; that is to say, more than twice as much as sfied him when he had enough of other matters to make up. At rate it would seem that fat can be formed from nitrogenous sub-ces, provided there is a deficiency of non-nitrogenous substances he food; and I may say that the nitrogenous substances are of a ner food capacity, irrespective of the nitrogen, containing more on, more hydrogen, and less oxygen; they have more useful ter in them than an equal weight of starch or any substance of kind.

ow the question arises, what is the state of affairs when we attempt alculate these results and to see whether or not the food did con- enough nitrogenous substances, or albuminous matter, to supply whole of the fat produced? These experiments were not specially nged to settle that question, but they were calculated afterwards. as about twenty-six years ago that we took two pigs of the same r, very carefully selected both by practical and scientific eyes as g as nearly as possible exactly alike. One was slaughtered, and total amount of dry matter, fat, nitrogen, mineral matter, and so determined; and then the other animal was fed. At that time we not arrived at such distinct conclusions as we did afterwards as to

the desirability of giving a greater proportion of starchy matters. We gave the animal a great deal more than the proportion of nitrogenous substances existing in what may be called the normal fattening food of the pig—barley meal. In the first column of the table, the results of that experiment are calculated out to show whether the food did contain enough nitrogenous matter to yield the fat produced. You will see the proportion of non-nitrogenous matter to one of nitrogenous is 3·6. Now, the proportion in barley meal, which is the best fattening food for the pig, is between 5 and 6 to 1; so that we gave too much nitrogen according to what we now know is the best proportion. There was a considerable amount of increase in ten weeks, eighty-eight pounds, or 85·4 per cent. on the original weight of the body.

The question is, how much fat was in the food? and that is shown in the second division of the table. It is calculated that for 100 pounds increase in the live-weight there were stored up 63·1 pounds of fat. There were of ready-formed fat in the food 15·6 pounds; leaving 47·5 pounds fat to be produced from some material or other. Out of 100 of nitrogenous substances consumed as food, there were stored up in increase 7·8, leaving 92·2 parts of nitrogenous substance which might be used for the production of fat or might not. If we calculate how much carbon there was in the produced fat, and how much there was left available in the nitrogenous substance for the production of fat, we find that there were 7·4 pounds more carbon possibly available from the nitrogenous substance than was necessary for the production of the fat; or, put in another way, there were 120 of carbon available from the nitrogenous substances for 100 required.

According to this mode of calculation, therefore, there was enough nitrogenous substance to justify the conclusion of Voit; or rather, the result does not in any way disprove his conclusion that fat has been produced from the disintegration of nitrogenous substances in the body. This table was calculated some years ago, and we have intentionally put the results in the worst aspect that we could for our own side of the case, that we might not exaggerate the conditions. For instance, we have assumed that the whole of the fat in the food would be taken up, which it certainly would not; and we have assumed that the whole of the nitrogenous substances of the food would be digested, and would come into play, which they certainly would not. If we assume in our own calculations the estimate adopted in Germany, that 100 pounds of nitrogenous substance cannot yield more than

ne of fat, even this experiment shows a little deficiency of nitro-
is substances, and would in fact be in favour of our view.
e next two experiments given in the table show a still higher
rtion of nitrogenous substance in the food; and there was,
dingly, a great deal more carbon available from the nitrogenous
ance than was necessary for the formation of the amount of fat
iced.
e next two experiments (four and five), were with more natural
ing food of the animal, one entirely Indian corn-meal, and
her entirely barley-meal. A pig requires for rapid fattening very
if any, more nitrogenous substance than this represents. But
ve have only 60 per cent. or a little over, 60·8 in one case, and
n the other, of the carbon of the fat produced in the animal, pos-
derivable from the nitrogenous substance of the food. So that we
in those two cases nearly 40 per cent. of the carbon of the produced
iich could not possibly come from the nitrogenous substances,
nust have come from the non-nitrogenous matter, in fact from
arbohydrates. But an objection may be raised to this calcula-
the animals were larger to begin with; and the weights were
er at the end; so that the composition of the lean animal, and of
t animal, as derived from the direct analyses, does not absolutely
; but we could not possibly thus get rid of this forty or more
ent. which the calculations would show to be derived from the
itrogenous substance of the food.
e remaining four experiments are also entirely in favour of our
The animals were about the same weights as those analysed:
ood was more nearly the proper food for fattening, being rather
in nitrogenous substances, but much higher than in experiments
l 5. But even here we found 18·9, 18·8, 25·2, and 14·1 per cent.
e total carbon of the produced fat could not possibly have been
ed, and certainly a great deal more was not derived, from the
genous substances of the food.
ieed not trouble you further with these results. But I should
iat the contrary view has been adopted not only by some physio-
s, but in Germany in some text books on agricultural chemistry.
d in my hand one of these text books in which the evidence of
experiments is discarded, and it is assumed that if you cannot
iment with the respiration apparatus the results are good for
ig. I would not wish to depreciate the importance of the results
ied by the respiration apparatus in any way. I have taken the

greatest interest in them, and I think they lead to the most important conclusions; but I also think some observers have come to very erroneous conclusions from the results of such experiments. I submit that if you experiment with *the* fat-producer—the pig—and if you take two carefully selected animals (or more if you like) kill and analyse one, and feed the other as rapidly as possible, that is, let him take as much of the most appropriate food as he will take, you may, without any respiration apparatus, determine this point. It is most important that it should be definitely settled. Since the recent publications on the subject, Mr. Lawes and myself have gone thoroughly into the question, and re-calculated most of our results; those relating to oxen and sheep as well as pigs. They point to this: that the ruminant animals, which have such elaborate machinery, and do so little productive work, do pass so much nitrogenous substance through the body in relation to the amount of increase, that they do not show that fat can be derived from the non-nitrogenous substances of the food; but in the case of pigs the evidence is perfectly conclusive. Having re-calculated our own experiments in this way, and the results being absolutely conclusive so far as the pig is concerned, Mr. Lawes is unwilling to be at the trouble and expense of further experiments on the question; but it really is one of great importance, and one which public institutions might well take up. It is of importance, not only agriculturally, with reference to the proper way of feeding stock, but also in its bearings on the nutrition of man.

[For the tables and diagrams referred to above, see—"On the Sources of the Fat of the Animal Body," *Philosophical Magazine*, December, 1866; and—"On the Formation of Fat in the Animal Body," *Journal of Anatomy and Physiology*, Vol. xi., Part iv.; and for other points, and detail—"Food in its Relations to Various Exigencies of the Animal Body," *Philosophical Magazine*, July, 1866; and the papers therein referred to.]

ON

THE FORMATION OF FAT

IN

THE ANIMAL BODY.

BY

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N THE FORMATION OF FAT IN THE ANIMAL BODY[1].

PLATE XXII.

RMERLY it was supposed that the fat of the Herbivora was rived exclusively from ready formed fat in their vegetable d. Liebig showed that this could not be the case; and he ributed much of the fat of the animal body to the carbodrates of the food. His views on the point were at first called question by Dumas, Boussingault, and others, but afterwards cepted. Our own very numerous feeding experiments, comncing about 30 years ago, together with a careful consideran of the experience of practical feeding, afforded strong afirmation of Liebig's conclusions; and more especially in 52[2], and subsequently, we pointed out the bearing of the sults on the question.

At a meeting of the Congress of Agricultural Chemists held Munich, in 1865, Professor Voit combatted this view. From e results of experiments with dogs, made in Pettenkofer's spiration-apparatus, he maintained that fat must have been oduced from the transformation of nitrogenous substance; d further, that this was probably the chief, if not the only, urce of the fat, even of Herbivora. In 1869 he elaborately gued the point, not only in reference to the results of his own periments with dogs and with cows, but also to the records those of various other experimenters, with various descripns of animal; and he has subsequently made further conbutions on the subject, conjointly with Professor Pettenkofer. their results, obtained with a dog, and their conclusions awn from them, were to be described in a few words, they ight perhaps be so as follows:—When a dog was fed on starch sugar, alone, or with albumin, or with fat and albumin, the rbon stored up was not more than that in the fat of the food

[1] The substance of this paper was given by one of us at the Naturforscher sammlung (Section für Landwirthschaft- und Agricultur-Chemie) at Hamg, in September, 1876.

[2] On the Composition of Foods in relation to Respiration and the Feeding of mals. *Report of the British Association for the Advancement of Science, for* 2.

plus that which could be derived from the albumin broken up. There was, therefore, no proof that fat can be formed from the carbo-hydrates. Again, when a dog was fed with starch and a little fat, but no albumin, the carbon stored up was equal to that of the fat of the food *plus* that derived from the transformed nitrogenous substance of the body. More starch reduced the amount of carbon stored up; the carbo-hydrate having protected the albumin of the body from oxidation, and thus limited the formation of fat. They never found fat formed from starch or sugar. They maintain that the same must occur with the Herbivora; and that to establish the formation of fat from the carbo-hydrates, experiments must be brought forward in which the fat deposited is in excess of that supplied by the food *plus* that which could be derived from the transformed albumin.

This, many of our own experiments with pigs do clearly show; and in 1866 we published a short paper[1], in which we illustrated the bearing of some of them on the point. In his paper in 1869[2], Professor Voit quotes some of those results, and admits that in the experiments in which there was only a medium albuminous supply in the food, there was, as the figures stand, a considerable deficiency for the formation of the fat produced, and a greater deficiency still in the cases in which the relation of the nitrogenous to the non-nitrogenous constituents was such as experience has shown to be the most favourable for pig-fattening; and that, therefore, a considerable amount of fat would, in these instances, appear to have been derived from the carbo-hydrates. Still, Professor Voit says he cannot allow himself to consider a transformation of carbo-hydrates into fat to be proved thereby. He confesses that he has not been able to get a general view of the experiments out of the mass of figures recorded, and suggests several possible sources of error, his reference to some of which shows that he has in fact misunderstood them. At the same time, he proposed that new experiments with geese and with pigs should be made, in order to arrive at a final decision on the question; and in a very recent

[1] On the Sources of the Fat of the Animal Body. *Philosophical Magazine*. December, 1866.

[2] *Zeitschrift für Biologie*. Band v.

ıversation with one of us, he expressed his willingness to lertake a conclusive experiment with pigs.

Weiske and Wildt[1] undertook an investigation to deterne the point; which, from a theoretical point of view, was l conceived; but which did not succeed, owing to the rsight of the conditions indicated by experience as essential the rapid fattening of the animal. They selected four pigs; were slaughtered to determine the initial composition; one fed on food so rich in nitrogen that it suffered in health, the experiment had to be discontinued; the other was on food so poor that it fattened extremely slowly; and ce, at the conclusion, calculation showed that there was ugh of the consumed nitrogenous matter available for fatnation to cover the whole of the fat which had been proed.

Thus, it has been concluded from experiments with animals ch are not preeminently fat-producers, that fat is probably er formed in the body from the carbo-hydrates; and some he experiments with more suitable animals have been, to say least, inconclusive. Further, it seems to be assumed, that absolute proof on the point can be obtained without the of a respiration-apparatus. These views, moreover, have ady been adopted, not only by some physiologists, but in ıe text-books treating of the application of chemistry to the ling of the animals of the farm. Thus, Professor Emil Wolff, ıis *Landwirthschaftliche Fütterungslehre*—although he admits t the amounts of increase produced in relation to constituents ood consumed, which it is established by common observation y be obtained with pigs, and still more those recorded in ıe direct experiments with those animals, are almost incomhensible without assuming the direct concurrence of the oo-hydrates in the formation of fat—nevertheless, seems onsider that evidence of the kind in question, and we supe our own, therefore, is inconclusive. He says that exact eriments are still wanting; and he suggests that accurate piration-experiments with pigs should be made, to settle nitively whether the carbo-hydrates, as well as albumin, contribute directly to the formation of fat in the animal body.

[1] *Ib.* Band x.

Since the appearance of Professor Emil Wolff's work, and the publication of the negative results of Weiske and Wildt, we have carefully reviewed and recalculated many of the results of our feeding experiments, including those with oxen, with sheep, and with pigs; in order to satisfy ourselves whether any doubt could be entertained of the views we have previously advocated; and whether, therefore, it was at all incumbent upon us to institute new experiments on the point. The result of this examination, so far as the ruminant animals are concerned, has been to show that, owing to the comparatively small amount of increase obtained with them from a given amount of constituents consumed, the quantity of nitrogenous substance passed through the system for the production of a given amount of increase was, in most, if not in all cases, so large as, in the absence of proof to the contrary, to admit of the assumption that the whole of the fat formed had its source in transformed nitrogenous matter. At any rate, no absolute proof of the derivation of fat from the carbo-hydrates can be obtained from data of the kind in question relating to such animals. In deciding the point in regard to them, the evidence afforded by the analysis of the fæces and of the urine, and by the determination of the products of respiration, must also be brought into consideration. It was quite otherwise, however, in the case of our experiments with pigs; in many of which much more fat was produced than could possibly have been derived from transformed albumin of the food. We concluded, therefore, that we were in no way called upon to institute new experiments, and decided, instead, again to direct attention to the results quoted in the short paper on the subject published in 1866, as already referred to.

The figures given in Table I. of that paper show how much smaller is the proportion of alimentary organs and contents in a given live-weight of the pig than of either oxen or sheep; that, in proportion to a given live-weight, the pig consumes a very much larger quantity of dry substance of food within a given time (whilst his food contains a very much larger proportion of digestible, and therefore, very much less of necessary effete matter); that he gives several times as much increase in relation to a given live-weight within a given time; much more increase in relation to a given quantity of dry substance

od; also a larger proportion of fat in that increase. Fur-, the most appropriate fattening food of the pig contains a ɜr proportion of readily digestible carbo-hydrates than that ıe ruminant animals. All these conditions indicate the pig e the most suitable animal for the determination of the t in question.

The results selected to illustrate the main point are given able II. of the same paper. They were all obtained more 20, and some more than 25 years ago; and the rations not arranged with a special view to the settlement of question; but to determine the relations of the different tituents of food to various exigencies of the body, and the unt, and the proportion of different foods which were the favourable for the feeding of the animals. Accordingly, series included proportions varying from 2·0 to 6·6 parts on-nitrogenous to 1 of nitrogenous substance in the food.

In experiment 1, two animals were selected, of the same r, and as nearly as possible alike both in character and ht; the weight of the one being 100 lbs., and that of the r 103 lbs. One was slaughtered at once, and its contents of ogenous substance, fat, mineral matter, &c., accurately de-ined. The other was fed on a mixture consisting of bean-l, lentil-meal, and bran, each one part, and barley-meal 3 parts, given *ad libitum*, but accurately weighed, for a pe-of ten weeks, when it had nearly doubled its weight. The contained, however, a considerably higher proportion of ogenous to non-nitrogenous constituents than is recognised ıe most favourable for the fattening of the pig. The ani-was then slaughtered, and analysed, as the other had been. composition of the food was also determined by analysis. experiment afforded, therefore, reliable data for determin-the amounts of fatty and nitrogenous substance consumed, amount of nitrogenous substance stored up in the animal ıch, and also the amount of fat stored up.

Eight other experiments were quoted, in each of which a rent food-mixture was employed, and in each of which e animals were fed, in some cases for a period of eight, and thers of ten weeks. The average live-weight per head at commencement was, in these eight experiments, respec-

tively, 143, 147, 144, 149, 95, 95, 94, and 97 lbs. Thus, in the first four cases, the average initial weight per head was notably more than that of the two animals of experiment 1; but in the last four experiments it was very nearly the same. In the calculations, the percentage composition of the animals in experiments 2—9 was assumed to be the same at the commencement as that of the unfattened animal in experiment 1, and the same at the conclusion as that of the fattened animal in experiment 1. It was quite obvious, during the progress of the experiments, that the animals having the higher proportions of nitrogen in their food, grew more, and fattened less, than the others; and careful observations, made after slaughtering, entirely confirmed this. The tendency to error in the calculations would be to indicate too low an amount of nitrogenous substance, and too high an amount of fat stored up in the cases with the higher proportions of nitrogenous substance in the food, and too high an amount of nitrogenous substance, and too low an amount of fat stored up with the lower proportions of nitrogenous substance consumed. The range of the probable error here supposed is, however, not such as at all to throw doubt on the validity of the main conclusions which are drawn from the figures as they stand.

A comparison of the amount of ready-formed fat in the food, with that of the determined or estimated total fat stored up in the increase of the respective lots of animals, showed that, even supposing the whole of that consumed had been retained, there remained from two-thirds to nine-tenths of the total amount stored up to be otherwise accounted for. It must have been produced within the body.

The next question was, whether this large amount of produced fat could possibly have been derived from the nitrogenous constituents of the food? or whether it must of necessity have had its source, in greater or less proportion, in the carbohydrates at the same time supplied?

Deducting from the total amount of nitrogenous substance consumed, the small amount estimated to be stored up as such in the increase of the animal, there remained a large proportion available, it may be, for the formation of fat, with other products. In order to give to the nitrogenous substance of the

food not stored up, its fullest possible (and even more than its fullest) value for fat-formation, the whole of its carbon, *minus* that which its nitrogen would require to form urea, is, for the sake of illustration, assumed to be available for fat-formation.

So calculated, the result in experiment 1, and also in two of the other cases in which the proportion of nitrogenous to non-nitrogenous substance in the food was considerably higher than is recognised by experience as the most suitable in the fattening food of the pig, was that more nitrogenous substance was available for fat-formation than was necessary to supply the estimated amount of produced fat. In the cases in which the nitrogenous substance was not so excessive, but still more than is the most appropriate, there was a considerable proportion of the total produced fat which could not possibly have been derived from the nitrogenous substance of the food. Lastly, when the proportion of the nitrogenous to the non-nitrogenous substance in the food was the most appropriate for fattening, there was a much larger proportion (about 40 per cent.) of the total produced fat, which could not possibly have had its source in the nitrogenous substance consumed.

Striking as are these results, it is obvious that a still larger proportion of the produced fat would appear to be formed from the carbo-hydrates, if it were assumed, with Henneberg and Voit, and as is doubtless nearer the truth, that 100 parts of albumin will not yield more than 51·4 parts of fat, instead of, according to the foregoing illustration, about 61 parts.

It will be well, however, briefly to consider, whether an amount of error in the estimates, which would turn the scale, and show that the whole of the produced fat might be derived from the nitrogenous substance of the food, is at all conceivable, at any rate in the cases in which the proportion of the nitrogenous to the non-nitrogenous constituents consumed was the most nearly that which is recognised as the most favourable for pig-fattening, and in which the largest amount of formation from the carbo-hydrates is indicated.

Obviously, the most important point to consider is the range of error admissible in the estimation of the fat stored up in the increase of the animal.

It would be necessary to reduce the estimate of the amount of fat stored up by more than 30 per cent. to bring it low enough to be covered by the fat in the food, *plus* that derivable from the transformed nitrogenous substance, leaving all the other calculations the same. If, however, we were to assume that 100 nitrogenous substance yielded only 51·4 fat, it would be requisite to reduce the estimate of the fat in the increase by more than 40 per cent., to reverse the indication. This is on the assumption that the whole of the fat of the food was stored up in the animal, which would certainly not be the case. It is also on the assumption that the whole of the nitrogenous substance of the food, not stored up as such in the increase, was digested, and available for transformation into fat, &c., but this again is certainly not the case. According to our own experiments, it may be supposed that, with a pig feeding exclusively on good barley-meal, about one-sixth of the total nitrogen voided would be in the fæces. But if it be assumed, according to the estimates of E. Wolff[1], that 20 per cent. of the nitrogenous substance, and 32 per cent. of the fat of the barley, would be voided undigested, and therefore without contributing to the deposition of fat, our estimate of the amount of fat stored up in the increase would have to be reduced by more than 55 per cent., or considerably more than half, to bring it within the amount derivable from the resorbed fat, and the transformed nitrogenous substance of the food.

It is submitted that a range of error in our estimates, at all approaching even the lowest of those above assumed for the sake of illustration, is simply impossible. It is further submitted, with the utmost confidence, that such is the wide margin in the case of pigs fattening rapidly on their most appropriate fattening food, that the question of whether or not the carbo-hydrates contribute to fat-formation may be conclusively settled by a properly conducted experiment with those animals, without any analysis of the fæces or the urine or any determination of the products of respiration. To this end, we would suggest that two animals be selected, of a breed of good fattening quality, and as nearly as possible alike in characters and in weight. A convenient size and weight would

[1] *Landwirthschaftliche Fütterungslehre*, Appendix, Table I.

, say about 90 lbs. per head. Let each be fed with ground rley of good quality, giving it, by degrees, as much as it will nsume, until both weigh about 100 lbs. Then slaughter one, d determine its total amount of nitrogenous substance, fat, . Feed the other in the same way, that is with barley-meal nd water) exclusively, as much as it will consume, until it aches about 200 lbs. in weight. Then slaughter and analyse as the first. The quantity and composition of the food ist, of course, also be determined. Such an animal would nsume somewhere about 500 lbs. of barley, more or less, and crease from 100 lbs. to 200 lbs. in live-weight, in from 8 to weeks, more or less, according to quality of the animal, ality of the food, &c. &c. It is desirable that the animals lected should have been feeding on fairly good food pre-ously, so that the transition to full fattening food should not too sudden. It is also, of course, desirable, that the ex-riment should be made in duplicate if possible.

But, independently of the results of any such experiments, may be asked, what is the lesson of common experience this matter? We say, unhesitatingly, that the experience the feeding of animals fully confirms our view.

In reference to this point we would call attention to the loured diagrams Pl. XXII. which show the proportions of trogenous substance (black), of non-nitrogenous substance ellow), and of total organic substance, nitrogenous and non-trogenous together (blue), respectively:—

I—consumed per 100 lbs. live-weight per week,

II—consumed to produce 100 lbs. increase in live-weight,

the case of thirty different feeding experiments with pigs, ch of which comprised not less than three and some four imals, and in each of which they fixed their own consump-n[1]. That is to say, various current foods, but containing dely different percentages of nitrogenous substance, being ected, one (or a mixture) of high, or of medium, or of low

[1] "Pig Feeding;" *Jour. Roy. Ag. Soc. Eng.* Vol. XIV. Part 2; Experiments -8, and 12, Series 1; Experiments 1—12, Series 2; Experiments 1—5, Series also "On the Equivalency of Starch and Sugar in Food," *Report of Brit. Ass.* 1854; Experiments 1—4. See also "Experimental Enquiry into the com-sition of some of the Animals fed and slaughtered as human food." *Phil. ans.* 1859, Part 2.

percentage of nitrogen, was given, *ad libitum;* or a fixed quantity of one or more was given, and another given *ad libitum;* and so on. In this way the animals fixed their own consumption, and from the results it may be judged by what requirement this was guided.

First, as to the consumption by a given live-weight within a given time; which of course met the collective requirements for both sustenance and increase. Diagram I illustrates this point. The lowest amount of nitrogenous substance so consumed in any one of the thirty experiments is taken as 100; and it is seen that the amount of it consumed ranged, among the thirty dietaries, from 100 parts to more than 300; and it averaged more than 200. Reckoned in the same way, the consumption of non-nitrogenous substance varied from 100 to only 177 parts, and averaged only 141 parts. Again, reckoned in the same way, the consumption of total organic substance (nitrogenous and non-nitrogenous together) ranged from 100 to only 150 parts, with an average of 125 parts.

Secondly, as to the amounts consumed to produce 100 lbs. increase in live-weight. Diagram II shows that, for this result, the consumption of nitrogenous substance ranged from 100 to 282 parts; and it averaged 173 parts. That of the non-nitrogenous substance ranged from 100 to only about 140 parts, with an average of 124 parts; and that of the total organic substance (nitrogenous and non-nitrogenous together) from 100 to only 147 parts, with an average of 122 parts.

It should be explained that, as in the Tables and Diagrams given in the original papers above referred to, the *total* amounts of nitrogenous and of non-nitrogenous substance, in the different foods, are taken as the basis of the calculations; no deduction being made for "indigestible" matter; nor is the fat in the food reckoned at any higher value than the other non-nitrogenous constituents. This plan was adopted as best representing the facts actually determined by analysis; but attention was at the same time directed to the varying amounts of indigestible matter in the different foods, and to the greater or less amounts of fat which they contained. We have, however, quite recently recalculated the whole of the experiments, making deduction for indigestible or undigested matter, according to E. Wolff's

ıble already quoted, and with him multiplying the amounts fat by 2·5, and have constructed Diagrams according to the ta so obtained. These still more strikingly illustrate the int in question than the Diagrams herewith given ; that is to y, they show a wider range in the amounts of the nitrogenous bstance consumed in the different experiments, a less varia›n (excepting in one case in which there was much fat) in the nounts of the non-nitrogenous substance consumed, and pecially a less range in the amounts of the total organic bstance consumed. The two methods of calculation show, ›wever, in most of the cases, much less difference in the rela›n of the nitrogenous to the non-nitrogenous constituents than ight have been anticipated. With this explanation, we still lhere to our original plan of calculation, rather than adopt rrections based upon factors as yet not sufficiently established[1]. t the same time, we repeat that the points here indicated ould be considered in judging of the results as they stand.

It is then perfectly clear, that neither the amount of food nsumed in relation to a given live-weight within a given ne (which of course covered the requirements for increase well as sustenance), nor the amount taken to yield a given ıount of increase in live-weight (which in its turn covered ɜ requirements for sustenance also), was at all in proportion the amount of the nitrogenous constituents it supplied. is quite obvious, that the consumption, both for sustenance d for increase, was much more nearly in proportion to the ıount of digestible non-nitrogenous constituents supplied; t it was more nearly still guided by the amount of the al digestible organic substance—nitrogenous and non-nitro›ous together—which the foods contained.

That the great variation in the amount of nitrogenous ›stance consumed was not due to a deficiency of it in most the foods employed, is shown by the fact that it was in the ›eriment in which the food contained the lowest proportion it, that the smallest amount of nitrogenous matter was only consumed in relation to a given live-weight within

[1] Professor Emil Wolff has recently determined the proportions undigested the different constituents of cocoa-nut cake, barley-meal, maize-meal, and -meal, in actual experiments with pigs. *Versuchs-Stationen Organ.* Band No. 4, 1876.

a given time, but was required to produce a given amount of increase. It is obvious, that where two or three times as much nitrogenous substance was consumed, it was much in excess of the normal requirement. In fact, the animals consumed almost regardless of the amount of nitrogenous substance supplied, until they had obtained a sufficiency of non-nitrogenous, or of total organic substance. It is further obvious, that the range of variation in the amounts of non-nitrogenous constituents consumed would have been very much less, but for the very variable amount of nitrogenous substance necessarily taken with it, the variable amounts of fat in the foods, and the greater amount of indigestible matter in some of them than in others. The indication is, indeed, that the excess of nitrogenous substance consumed substituted a certain amount of non-nitrogenous constituents; that, in fact, within certain limits, the two classes of constituents may, for the purposes of respiration and fat-formation, mutually replace each other.

Lastly on this point, not only did neither the amount of food consumed, nor the amount of increase in live-weight yielded, bear any relation to the amount of nitrogenous substance supplied, but the more excessive the supply of it the greater was the tendency to grow, and the less the tendency to fatten. There is, of course, a point below which the proportion of nitrogenous substance in the food should not be reduced; but if this be much exceeded, the proportion of the increase, and especially of the fat-increase, to the nitrogenous substance consumed, rapidly decreases; and it may be stated generally, that taking our current fattening food-stuffs as they are, it is their supply of digestible non-nitrogenous, rather than of nitrogenous constituents, which guides the amount, both of the food consumed, and of the increase produced, by the fattening animal.

In conclusion, we repeat that, in many of our experiments with pigs, much more fat was produced than could possibly have been derived from the albumin of the food, and hence the carbo-hydrates must have contributed directly to its formation; further, that experience in practical feeding is entirely in accordance with our views on the point.

15

[*From the* PROCEEDINGS OF THE ROYAL SOCIETY, No. 226, 1883.]

upplement to former Paper entitled—'Experimental Inquiry into the Composition of some of the Animals Fed and Slaughtered as Human Food,'—Composition of the Ash of the Entire Animals, and of certain Separated Parts." By Sir JOHN BENNET LAWES, Bart., LL.D., F.R.S., F.C.S., and JOSEPH HENRY GILBERT, Ph.D., LL.D., F.R.S., V.P.C.S.

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(Abstract.)

n a former paper ("Phil. Trans.," Part II, 1859) the authors had en the actual weights, and the percentage proportion in the entire y, of the individual organs, and of certain more arbitrarily rated parts, of 326 animals—oxen, sheep, and pigs—in different litions as to age, maturity, fatness, &c. They called particular ntion to the wide difference in the proportion by weight of the nachs and intestines in the three descriptions of animal; the pro-ion of stomach and contents being very much the highest in oxen, siderably less in sheep, and little more than one-tenth as much in as in oxen. On the other hand, the intestines and contents con-uted a less proportion to the weight of the body in oxen than in er sheep or pigs; the percentage by weight in pigs being nearly e as high as in sheep, and more than twice as high as in oxen. h these very characteristic differences in the proportion of the ptacles and first laboratories of the food, the other internal organs ectively, as also the blood, contributed a pretty equal proportion weight of the entire body, in the three descriptions of animal.

'en animals had been selected for the determination of the chemical position, namely—a fat calf, a half-fat ox, and a fat ox; a fat b, a store sheep, a half-fat sheep, a fat sheep, and a very fat sheep; ore pig, and a fat pig. In these, in the collective carcass parts, in collective offal parts, and in the entire bodies, the total nitrogenous stance, the total fat, the total mineral matter, the total dry sub-ice, and the water, were determined; and the results were recorded discussed in detail.

was shown that, as the animal fattened, the percentage of nitro-ous substance decreased considerably, whilst that of the fat and of total dry matter increased in a much greater degree. It was nated that the portions of well fattened animals which would be umed as human food would contain three, four, and even more es as much fat as dry nitrogenous substance; and comparing such nal food with wheat-flour bread, it was concluded that, taking into ideration the much higher capacity for oxidation of a given weight

of fat than of starch, such animal food contributed a much hig
proportion of non-nitrogenous substance, reckoned as starch, to on
nitrogenous substance than bread. In fact the introduction of
staple animal foods, to supplement our otherwise mainly farinac
diet, did not increase, but reduced, the relation of the flesh-form
material to the respiratory and fat-forming capacity of the food.

Finally, the actual amount, and the percentage, of total ash, in r
of the internal organs, and some other separated parts, were given
was shown that the percentage of total mineral matter, like
of the nitrogenous substance, decreased, not only in the entire b
but especially in the collective carcass parts, as the animals matu
It was the object of the present communication to record the resul
the complete analysis of the ashes of the collective carcass parts, of
collective offal parts, and of all parts, of each of the ten anin
Forty complete ash analyses had been made.

As was to be expected, more than four-fifths of the ashes consi
of phosphoric acid, lime, and magnesia; these making up the lar
amount in the ash of the oxen, less in that of sheep, and less sti
that of pigs. Potash and soda were also prominent constitu
Assuming, for the purposes of illustration merely, that one of p
phoric acid was combined with three of fixed base, the ashes of
ruminants showed an excess of base; whereas, according to the s
mode of calculation, the ashes of the pigs showed no such excess.

It was, unfortunately, only in the case of the offal parts of the
that the ash of the chiefly bony, and that of the chiefly soft parts,
been analysed separately. The results showed a considerable ex
of acid, especially phosphoric, in the ash of the non-bony porti
presumably, in part at any rate, due to the oxidation of phosph
in the incineration. In further reference to the point in questio
may be stated that although the oxen and sheep show a higher
centage of total nitrogenous substance than the pigs, yet the amo
of pure ash yielded from the non-bony parts is higher in propor
to that from the bones in the case of the pigs than in that of
ruminants.

Comparing the percentage composition of the ashes of the en
bodies of the different animals, the chief points of distinction were
—in the ash of the pigs there is a lower percentage of lime, an
higher percentage of potash and soda, than in the corresponding as
the ruminants; there is a somewhat higher percentage of phosph
acid in the ash of the pigs and of the oxen than in that of the sh
and there is a higher percentage of sulphuric acid (and somewh
chlorine also) in the ash of the pigs than in that of the other anin

A table showing the quantities of total ash, and of each indivi
mineral constituent, in each of the ten animals analysed was gi
Not much stress was laid on the amounts in the particular ani

analysed; as the actual weights and condition of animals coming under similar designations may vary considerably.

It was of more interest to consider the amounts of the mineral constituents in carcass parts, in offal parts, and in all parts, per 1,000 lbs. fasted live-weight, of each description of animal.

It was shown that a given live-weight of oxen carried off much more mineral matter than the same weight of sheep, and a given weight of sheep much more than the same weight of pigs. With each description of animal the amounts of phosphoric acid, lime, and magnesia, are less in a given live-weight of the fatter than of the comparable leaner individuals. Of both potash and soda, again, the quantity is less in a given live-weight of the fatter animals. The same may be said of the sulphuric acid and the chlorine; in fact, in a greater or less degree, of every one of the mineral constituents.

It was estimated that the loss to the farm of mineral constituents by the production and sale of mere fattening increase was very small. It was greater of course in the case of growing than of only fattening animals. In illustration, the amounts of some of the most important mineral constituents removed annually from an acre of fair average pasture and arable land in various products were compared. Such estimates could obviously be only approximate, and the quantities will vary considerably. With this reservation, it may be stated that, of phosphoric acid, an acre would lose more in milk, and four or five times as much in wheat or barley grain, or in hay, as in the fattening increase of oxen or sheep. Of lime, the land would lose about twice as much in the animal increase as in milk, or in wheat or barley grain; but perhaps not more than one-tenth as much as in hay. Of potash, again, an acre would yield only a fraction of a pound in animal increase, six or eight times as much in milk, twenty or thirty times as much in wheat or barley grain, and more than 100 times as much in hay.

From the point of view of the physiologist, it would doubtless have been desirable that the selection of parts for the preparation and analysis of the ash should have been different, and more detailed. The agricultural aspects of the subject had, however, necessarily influenced the course of the inquiry; and the extent of the essential work had enforced the limitation which had been adopted. The results must be accepted as a substantial contribution to the chemical statistics of the feeding of the animals of the farm for human food.

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EXPERIMENTS ON ENSILAGE,

CONDUCTED AT ROTHAMSTED;

SEASON 1884–5.

BY

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AND

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This paper is, in the main, a reprint of a series of Articles published in the "Agricultural Gazette," from April 27 to August 10, 1885, as the experiments proceeded; but the order of the sections has been re-arranged, the Tables and text have been revised and corrected, and a more complete summary has been added.

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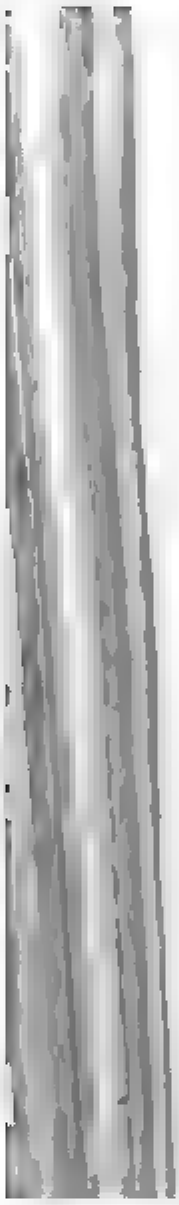

CONTENTS.

[?]PERIMENTS ON ENSILAGE,

CONDUCTED AT ROTHAMSTED;

SEASON 1884-5.

1.—Introduction.

ɴɢ to the "Agricultural Returns," there had, in 1884, been
ı constructed in Great Britain, and in 1885, the number was
ı 1183. It is probable that the greater portion of these are
he hands of tenant farmers, as even at the best of times they
over eager in adopting novelties; and now, when the most
lepression exists, they may readily hesitate to pay even the
upon a building which after trial might be found to be

uite certain that, in some of the statements which have been
the more enthusiastic advocates of ensilage, there has been
ɪaggeration, and that the revolution which the silo was to
our system of agriculture has yet to take place.

ɜ early part of 1884, a visit paid to Mr. Gibson's farm at
Walden, where the system of ensilage was in full operation,
o show that the process was worthy of careful investigation;
Gibson kindly supplied much valuable information, essential
ling as to the points which required to be investigated.
ɪon's system of feeding was, to give the silage mixed with
ıd when used in this way, with dry food in addition, the milk
er yielded by the cows were both of good quality. He had
rtained that clover-silage was superior to that made from
;rass.

Although Mr. Gibson's experience is of great practical value, it does not afford much help in regard to the important question—what is the value of silage as compared with other foods? A great many points have to be investigated before we can assign to the system of ensilage its proper value in the economy of the farm. We want to know, how good a food silage is generally—and especially the silage made from various crops—both as compared with roots, and with the same crops used in the ordinary way. We further want to know, what are the changes that take place in the pit, and how many pounds of dry matter are taken out for 100 lbs. put in; for neither sour nor sweet silage can be made without the destruction of some of the food.

Any one who has had much experience with cows, and the products of a dairy, will understand at once that where the object of experiments is to ascertain the value of one food compared with another, in the production of milk or butter, the subject is surrounded with difficulties. In the feeding of fattening animals, if a sufficient number of them are under experiment, and the food is carefully weighed, it may be expected that the increase in live-weight will give an approximately correct indication of the feeding value of the foods used. With cows, however, not only has every change of food some influence on the yield of milk, but the same food, given in the same quantity, will produce very different amounts of milk with different cows.

It is also well known that milk may be produced at the expense of the substance of the cow herself. The animal may not be even losing weight for a short time, and still may be parting with solid matter which is replaced by water. This being the case, all experiments over short periods, in which one food is substituted for another, are liable to the serious objection, that it is not possible to say what is the source of the change in the milk production. As every cow has a certain milk producing capacity, which cannot be exceeded by any manner of feeding, the animal may be putting on flesh as well as yielding milk with one food, while it may only yield milk without putting on flesh with another food. It is evident that, in the first case, the food possessed a higher nutritive value than in the second; and, consequently, that it might have been reduced without lessening the production of milk. What has been said will be sufficient to show how difficult is the task of carrying out trustworthy experiments for the purpose of determining the influence of different foods on the production of milk or butter.

In addition to the inquiries respecting the comparative feeding value of silage made from different crops, it is very desirable that investigations should be carefully carried out in regard to the rela-

of food to the milk produced. In the Rothamsted dairy, as)ably in all dairies, some rough and ready plan is adopted for in- .sing or diminishing the more costly foods according to the amount ailk or butter yielded; but we are not aware of any experiments rhich the rise and fall of both milk and food have been made the ject of careful inquiry.

'ur experiments on the feeding of cows with silage were com- ıced in December, 1884, with red clover-silage, followed later with dow-grass-silage, and they were continued until the cows went to grass in the spring. Next year we propose to repeat some of experiments, with different foods, as it is very desirable that the parison between a corn crop cut green and put into a silo, and same crop left to ripen, should be made the subject of investiga- . Oats will probably be the crop selected for this purpose.

; is contrary to our usual plan, to publish the results of our expe- ənts before they are completed, and we have fully made up our ds as to the lessons to be learnt from them. There were, however, ons why an exception seemed desirable in the case of our ensilage ɘriments. We could at any rate supply sufficient information to ɔle practical farmers to draw their own conclusions from the lence brought before them. Any conclusions so put forward, 'ever, should be accepted as possibiy subject to modification as the ɔstigation proceeds.

.lthough many careful experiments are carried out on parts of the a at Rothamsted without regard to cost, on other parts the object) make a profit just as much as on any other farm. The dairy is ɔrdinary working dairy, intended to produce milk as cheaply as ɹible. A contract is generally made to furnish so many gallons of ε per day for a year, and it may be mentioned that for the past r the contract has been 17*d.*, 21*d.*, and 22*d.* for 17 pints vered at a railway station in London. Within certain limits, the ntity contracted for must be delivered. If more is produced it ıt be got rid of some other way; and if there is a deficiency the ' alternative is to purchase more cows.

ı addition to the cows, there are stock of all ages, bred on the ı, and about 40 Irish oxen are generally purchased in the autumn onsume the rough grass left by the cows. The land is mixed ıle and pasture, about equally divided. Much of the pasture is ɪg, and that which is old is not good. Sheep's fescue and Agrostis 'ail, while white clover and the better grasses can only be obtained ıigh animal manuring. For six months of the year the stock are in the fields, while during the other six months other food must rovided for them. A certain amount of succulent as well as dry is therefore required. For the former, mangels grown on the

farm, are generally depended upon; and for the latter, hay and straw, with a certain amount of purchased food.

Under these circumstances, which are as ordinary and commonplace as can well be imagined—and although milk only is sent to London, it would be the same if butter were made—the question to consider is: What benefit will be derived from the use of silage?

Each cow in milk requires about 7 tons of mangels during the 6 months, say, 60 cows × 7	420 tons
100 head of other stock, each 3½ tons mangels or swedes	350 tons
Total	770 tons

Estimating the dry matter in the roots to average 12 per cent., the 770 tons will give about 92½ tons of dry substance of food.

Ten tons of fresh cut grass, clover, or tares—equal to nearly 2½ tons of hay per acre—may be considered a full yield, and about one-fifth of the fresh weight would be dry matter. There would, therefore, be required 462 tons of the fresh green produce, or the produce of about 46 acres, to yield the same amount of dry matter as in the 770 tons of roots.

The question next arises—What crops should be grown for ensilage purposes? Should some of the corn crops be cut in the green state? should less roots be grown? or should clover, or pasture grass, be put into the silo?

With regard to the clover or pasture, there is the difficulty that a certain amount of hay is required for winter consumption, and if, in addition, a quantity of green grass were mown for the silo, less stock must be kept in the summer, which would be an objection. It is true that a rather better price is obtained for milk and butter in the winter; but, on the other hand, the cost of keep and attendance is much greater. Possibly it may be suggested that tares instead of roots should be grown; but the roots generally follow a second, and sometimes a third corn crop. Winter tares are an excellent crop, and of these a certain number of acres are always grown, but they are not to be compared with roots as a cleaning crop. In fact the substitution of a silage crop for roots, would be equivalent to giving up taking a barley crop after wheat.

If 25 tons of mangels were grown per acre, 28 acres would yield about 87½ tons dry substance of food, whilst of ensilaged crops it would require more than 40 acres to yield the same amount. The relative feeding values of these two descriptions of food form, therefore, a very serious matter for consideration. Of course, all the difficulties mentioned could be got over, if it were clearly shown that silage is a more profitable food. But without roots the land cannot

be cleaned, unless by means of summer fallow, which is out of the question; and that land should be fairly clean is, certainly, an essential point in successful arable farming.

Practical farmers will thus see that there are difficulties, which are by no means fanciful, in the way of an extended adoption of ensilage; and that, notwithstanding all that has been said in favour of the process, there is a simplicity, and economy, in feeding off clover on the land, and the summer feeding of grass, which it will not be easy to supersede. Some may even go so far as to say: "I don't care how good silage may be as a food, I cannot see my way to adopt it, for I must grow roots." Others may say, "It ought to be a very good food indeed for me to use it, for it has a most disagreeable smell, which pervades the whole farm." The general view will probably be that some further information, derived from carefully conducted experiments, is very desirable.

2.—The Construction, and the Filling, of the Silos.

In May (1884), the ground was excavated, and the building of the silos, of which there are two, was commenced. Each measured 15 feet by 13 feet 10 inches; the depth being 22 feet, 17 feet below the surface of the ground, and 5 feet above it. The silos are built of brick and cement, and are, in fact, water-tight tanks, with a corrugated iron roof over them. Each silo is calculated to hold from 100 to 120 tons of compressed silage, and it was intended to fill one with red clover, and the other with meadow-grass and oats; but as the oats advanced rather beyond the point which was considered desirable for the purpose, this part of the experiment was postponed until another year.

The first crop of red clover—which was pure clover without rye grass—was a very fine one. There was no rain during the filling of the silo, although, owing to the delay caused by the weighing and sampling, the operation extended from June 23 to June 30. The operations were as follows: every cart, as it came from the field, after passing over the weigh-bridge, was brought alongside the silo, and the clover was then passed through a chaff-cutter driven by steam; a sample of the chaff being taken from every load. Of the first crop, 98 tons were weighed in, several men and boys being employed within the silo to spread the chaff evenly, and tread it down. The material was first covered with boards fitting tolerably close, and then pressure was applied by means of hard Staffordshire bricks, weighing from 9 lbs. to 10 lbs. each. The pressure per square foot amounted to about 90 lbs.

At the end of August the boards were removed, and about 21 tons of a second crop of clover were weighed, chaffed, put in, and sampled.

After the pressure had been again applied the material did not reach within 4 feet of the top. The contents then measured 3706 cubic feet. The silage of the upper 4 feet weighed 45½ lbs., and that of the lower 4 feet, 59½ lbs. per cubic foot, giving an average weight of 53·6 lbs. per cubic foot.

The second silo was filled in exactly the same way as the first, the meadow-grass with which it was filled being taken from four different fields. It will be evident that any information regarding the cost of filling the silo would be of no value, as accuracy, and not economy, was the main object to be attained; and the operations are so simple that any practical farmer can form his own estimate on the subject. It must, however, be borne in mind, that in carrying fresh cut crops, four or five times as much weight has to be carted as would be the case if the crop were made into hay. Roughly speaking, 4 tons of fresh cut clover will make 1 ton of hay; so in all movements of the crop, either in or out of the silo, calculation for the extra amount of labour must be made accordingly.

3.—Quantity and Composition of the Herbage put into the Silos, and of the Silage taken out.

Silo No. 1.

Table I (p. 11) shows—the dates of filling Silo No. 1, the number of loads, the fresh weights of the clover as put in, the percentages of dry matter, ash, and nitrogen, in it, and the actual quantities of dry matter, ash, and nitrogen, put in.

Table II (p. 12) summarises the quantities of fresh clover, and of its various constituents, put into the silo; and it also shows—the quantities of silage, and of its various constituents, taken out; the actual loss of the various constituents; the percentage loss of each constituent, reckoning the total of each as 100; and the percentage loss of each constituent, reckoned on the total Fresh = 100.

We have thought it desirable that these results should be given as fully as possible, in order that those who will take the trouble to examine them, may form their own conclusions respecting them. This is especially desirable, as upon one very important point, namely the loss of constituents which occurs in the silo, we, and probably most of those who are interested in what may be called the chemistry of ensilage, have formed our opinions mainly on results which have been published by German or French chemists.

It would appear to be a very simple thing to estimate the loss which takes place in a silo. It may be said—"You have only carefully to weigh everything that goes in, and everything that comes out, and it is done." It will be seen, however, that a good deal more

First and Second Crop Red Clover.

Table I.—*Quantity and Composition of the Herbage put into Silo No. 1.*

Field.	When put in.	No. of Loads.	Fresh Weight.	Percentage composition. Dry matter.	Ash in dry matter.	Nitrogen in dry matter.	Total weight. Dry matter.	Ash.	Nitrogen.
				First Crop Clover.					
	1884.		lbs.	Per cent.	Per cent.	Per cent.	lbs.	lbs.	lbs.
ty acres............	June 23	20	34,776	16·35	10·80	2·942	5,686	614	167·3
	„ 23	20	39,035	16·66	11·80	2·866	6,503	767	186·4
	„ 23	5	8,827	19·99	9·68	2·781	1,765	171	49·1
	„ 24	15	24,462	18·40	10·72	2·920	4,501	483	131·4
	„ 24	14	25,654	19·26	10·92	2·793	4,941	540	138·0
	„ 28	21	34,965	23·02	10·28	2·578	8,049	827	207·5
ecroft	June 28	9	12,628	24·07	9·64	2·423	3,040	293	73·7
	28–30	15	23,670	21·32	8·98	2·382	5,046	451	120·2
	„ 30	9	13,677	22·83	8·87	2·385	3,122	277	74·5
	Total...	128	217,694	...	...	...	42,653	4,423	1148·1
				Second Crop Clover.					
ecroft	Aug. 25	4	6,950	19·13	8·61	2·616	1,330	115	34·8
	„ 25	2	3,590	22·66	8·92	2·704	813	73	22·0
	„ 26	8	12,831	17·10	10·45	2·688	2,194	229	59·0
	„ 26	3	5,088	17·92	10·15	2·668	912	93	24·3
	„ 26	4	5,483	18·56	8·45	2·502	1,018	86	25·5
	„ 26	3	4,786	18·72	9·22	2·623	896	83	23·5
	„ 26	6	9,032	21·90	9·15	2·524	1,978	181	49·9
	Total....	30	47,760	...	...	...	9,141	860	239·0
ghed off............	...	1	1,136	(19·43)	(9·28)	(2·618)	221	21	5·8
	Total....	29	46,624	...	...	...	8,920	839	233·2
				Summary.					
st crop clover......	...	128	217,694	...	...	...	42,653	4,423	1148·1
nd crop clover..	...	29	46,624	...	...	...	8,920	839	233·2
	Total....	157	264,318	...	...	...	51,573	5,262	1381·3
	Tons, cwts.		118 0	...	...	...	23 0½	2 7	0 12½

than this is required. So far as regards the total loss we have no difficulty. We weighed in 118 tons, and weighed out 88¾ tons, thus showing a loss of 29¼ tons. But the results further show that, of this loss, more than 28 tons consisted of water, and only about 1$\frac{1}{6}$ ton of dry or solid substance; the total loss of dry substance amounting to about 5 per cent. of that put in. It may be mentioned that this is very nearly the same amount of loss as that which we found had taken place in a large rick of about 40 tons of hay, after standing two years.

Careful experiments have been made in Germany, by Weiske and

Table II.—*Quantity and Composition—of the Herbage put into the Silo No. the Silage taken out; and actual, and Percentage, Loss of Constituents in the*

	Authority for Analyses.	Fresh.	Dry Matter.	Ash.	Nitrogen.	Dry Organic.	Crude Nitrogenous Substance = N × 6·25.	Crude Non-Nitrogenous Substance.
Herbage as put into the Silo No. 1.								
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Second crop clover ...	Rothamsted	46,624	8,920	839	233	8,081	1,456	6,625
First crop clover	"	217,694	42,653	4,423	1,148	38,230	7,175	31,055
Total	"	264,318	51,573	5,262	1,381	46,311	8,631	37,680
Silage taken out of the Silo No. 1.								
Second crop clover	Rothamsted	37,739	8,178	717	211	7,461	1,319	6,142
	Voelcker ...		8,069	766	203	7,303	1,269	6,034
	Mean ...		8,124	742	207	7,382	1,294	6,088
First crop clover ...	Rothamsted	160,731	40,791	3,548	1,062	37,243	6,638	30,605
	Voelcker ...		40,881	3,767	1,069	37,114	6,619	30,495
	Mean ..		40,836	3,657	1,061	37,179	6,629	30,550
Total	Rothamsted	198,470	48,969	4,265	1,273	44,704	7,957	36,747
	Voelcker ..		48,950	4,533	1,262	44,417	7,888	36,529
	Mean ...		48,960	4,399	1,268	44,561	7,923	36,638
Actual Loss of Constituents.								
Second crop clover	Rothamsted	8,885	742	122	22	620	137	483
	Voelcker ...		851	73	30	778	187	591
	Mean ...		796	97	25	699	162	537
First crop clover ...	Rothamsted	56,963	1,862	875	86	987	537	450
	Voelcker .		1,772	656	89	1,116	556	560
	Mean ..		1,817	766	87	1,051	546	505
Total	Rothamsted	65,848	2,604	997	108	1,607	674	933
	Voelcker ...		2,623	729	119	1,894	743	1,151
	Mean ...		2,613	863	113	1,750	708	1,042
Per Cent. Loss—Total of each Constituent=100.								
Second crop clover	Rothamsted	19·1	8·3	14·5	9·4	7·7	9·4	7·3
	Voelcker ...		9·5	8·7	12·9	9·6	12·8	8·9
	Mean ...		8·9	11·6	11·2	8·7	11·1	8·1
First crop clover ...	Rothamsted	26·2	4·3	19·8	7·5	2·6	7·5	1·4
	Voelcker ...		4·2	14·8	7·8	2·9	7·7	1·8
	Mean ...		4·3	17·3	7·6	2·8	7·6	1·6
Total	Rothamsted	24·9	5·1	18·9	7·9	3·5	7·8	2·5
	Voelcker ...		5·1	13·9	8·6	4·1	8·6	3·1
	Mean ...		5·1	16·4	8·2	3·8	8·2	2·8
Per Cent. Loss—Total Fresh=100.								
Second crop clover	Rothamsted	19·1	1·6	0·3	0·05	1·3	0·3	1·0
	Voelcker ..		1·8	0·1	0·06	1·7	0·4	1·3
	Mean ...		1·7	0·2	0·05	1·5	0·4	1·1
First crop clover ...	Rothamsted	26·2	0·9	0·4	0·04	0·5	0·2	0·2
	Voelcker ...		0·8	0·3	0·04	0·5	0·3	0·3
	Mean ...		0·9	0·4	[redacted]	0·5	0·3	0·2
Total	Rothamsted	24·9	1·0	0·4	0·04	0·6	0·3	0·3
	Voelcker ...		1·0	0·3	0·04	0·7	0·3	0·4
	Mean ...		1·0	[redacted]	0·04	0·7	0·3	0·4

Schulze, on the changes and losses in ensilaging; and as their results are familiar to all those who have studied the chemistry of ensilage, we propose merely to refer to them so far as to point out that with lupines, maize, and lucerne, the loss during fermentation amounted to between 22 and 36 per cent. of the dry matter. In some of the experiments one-third or more of some of the food-constituents contained in the green crops put in, was destroyed, while another portion was reduced in value. The experiments were made in tight casks, and in some cases the filling in and the putting on of the pressure were done at once; whilst in others the filling was extended to six or seven days. The latter was about the time occupied in the process in our own experiments.

In the German experiments the loss of water was very small, but there was a considerable loss of mineral matter. It has been generally held that, as in the fermentation of vegetable substances, which contain both organic and mineral matter, the destruction of the former necessarily increases the percentage of the latter, the difference between the amount of mineral matter in the fresh crop put into the silo and that in the silage taken out, would, in some degree, be a measure of the loss of organic matter during fermentation, and also be some check on the accuracy of the work. Weiske and Schulze point out, however, that owing to the sand, and other adventitious mineral matters, with which bulks of herbage from the field are always contaminated, the difference in the amounts cannot be relied upon as a basis of calculation. Our own results fully confirm this view. Indeed, they show a loss, and not a gain, of mineral matter in the silage, as compared with that in the clover put in. It is true that our loss of dry substance would only amount to 1 per cent. of the fresh herbage, and the loss of mineral matter to about one-third of 1 per cent.; but small as this loss appears to be, according to one set of analyses it amounts to 729 lbs., and to the other to 1000 lbs. in the total quantity of mineral substances contained in the 118 tons of clover that were put into the silo.

The complete explanation of this loss is not very obvious. It may be pointed out, however, that of the 16 samples of clover which were taken as the crop was chaffed and put into the silo, the variations in the percentage of ash are very great; the lowest being a little below 8½, and the highest nearly 12 per cent. of the dry substance.

The depth of the silage in the pit was between 17 and 18 feet; and its removal for feeding purposes was a daily operation extending over three months. It was taken out in four layers, each of 4 to 5 feet in depth. From each layer five, six, or more samples were taken for analysis. A quantity of 1000 lbs., or more, was weighed, and rapidly mixed on an asphalte floor, so as to avoid loss by evaporation as much

as possible; and from this samples were taken. To ascertain the range of loss by evaporation in such an operation several experiments were made, of which the following is an example:—

		lbs.
January 2.	Weight 11.30 A.M.	200
	„ 3 P.M.	199¾
	After turning over and mixing	199½
January 3.	Weight 10 A.M.	198
	Loss	2

On a very windy day the loss amounted to 2½ per cent., and on a still, damp day, it was less than ¼ per cent. On the 25th April, the weighing machine was taken into the silo, and a block of silage, about 3 feet by 2 feet by 3 feet deep, was cut out and immediately weighed in baskets, when the weight was found to be 814 lbs. It was then taken to the mixing floor, where it was turned over three times, and samples were taken from it. At the end of an hour the silage was again weighed, and the loss was found to be not quite 1¾ per cent. It was noticed that the floor, although previously quite dry, had become wet. It may also be mentioned that the weather was much warmer when this experiment was carried out, and that the silage was taken from the second silo, the first having been emptied some weeks previously.

It should be added that the silos, which, as already explained, were built of brick and cement, were filled very shortly after they were finished. This may to a certain extent have been a source of loss, as a good deal of the floor rested upon the chalk, which would carry away water very rapidly if there were any crack in the cement. It is quite possible, therefore, that some loss by drainage did take place. The late Dr. Voelcker gave the composition of the drainage from a silo as 90 per cent. of water, and 10 per cent. solid matter, of which more than one-third was mineral.

It seems somewhat difficult to suppose that the very large loss of water in the silo was wholly due to evaporation, when the loss of organic matter, by fermentation, was so small. But it is to be observed that the lower layers were removed more slowly than the others, so that the cut surfaces were longer exposed; whilst, as a matter of fact, the silage was drier towards the bottom. On the other hand, some drainage was observed soon after the filling and the application of the pressure, so that some at any rate of the loss was due to drainage. If we were to assume that drainage had taken place sufficient to carry off the whole of the apparent loss of minerals—amounting to 863 lbs.—in a solution of the strength of the liquid which was pressed out of a silo, and was analysed by the late Professor Voelcker, the loss of water by drainage would be 8 per cent., and by

evaporation 17 per cent.; but the actual loss by drainage was probably less than here supposed.

It is satisfactory to know that the Council of the Bath and West of England Society have voted a sum of money for the purpose of investigating the loss of nutritive substances which takes place during the fermentation of green crops in a silo; and it is to be hoped that the experiments will be carried out with the necessary care. It is evident that, until this important matter has been thoroughly sifted, all estimates in regard to the economy of ensilaging, as compared with the ordinary operations of the farm, are little better than guess-work.

Silo No. 2.

Silo No. 2 was similar in all respects to Silo No. 1, as already described; and was only divided from it by a 9-inch wall. From June 25 to July 2 (1884), about 45½ tons of first-crop meadow-grass, from four different fields, were first put in. The whole of the grass was of fairly good quality; but that from the second field was much the ripest. It was intended to follow with winter oats; but the hot weather brought the crop too forward to be suitable for silage; so the full pressure was applied.

The silo was opened on August 23, when, from that date to August 26, about 30½ tons of second-crop red clover were put in.

In the middle of October the weights were again removed, and about 6¼ tons of second-crop meadow-grass were put in. Part of this grass was from land which had already been mown once; and the rest was from a field which had been fed, and consisted chiefly of the portions which, having grown too strong, had been left by the stock.

As in the case of Silo No. 1, all the crops were chaffed, and the material was evenly spread and well trodden down, as it was put in.

Table III (p. 16) gives the fresh weights of each lot of herbage put into the silo; also the percentages, and the actual quantities, of dry matter, mineral matter, and nitrogen, which each contained.

Table IV (p. 17) summarises the amounts of fresh herbage, and its various constituents, put into the silo, and gives the amounts of silage, and of its various constituents taken out. It also shows the actual loss of each of the constituents in the silo, the loss per 100 of each, and the loss of each per 100 of fresh herbage put in.

Comparison of the results given in Table III, with those formerly given in Table I, relating to the herbage put into Silo No. 1, will show that whilst the dry matter in the first-crop clover put into Silo No. 1 ranged from under 17 to 24 per cent., and that of the second-crop clover from over 17 to under 23 per cent., the dry matter of the first-crop meadow-grass put into Silo No. 2 ranged from 24¾ to nearly 32 per cent., that of the second-crop grass was more than 38 per cent.,

FIRST AND SECOND CROP MEADOW-GRASS, AND SECOND CROP CLOVER.

TABLE III.—*Quantity and Composition of the Herbage put into Silo No. 2.*

Field.	When put in.	No. of Loads.	Fresh Weight.	Percentage composition. Dry matter.	Ash in dry matter.	Nitrogen in dry matter.	Total weight. Dry matter.	Ash.	Ni[illegible]
First Crop Meadow-Grass.									
	1884.		lbs.	Per cent.	Per cent.	Per cent.	lbs.	lbs.	lbs.
Broadbalk and Appletree	June 23-26	29	4[illegible]	24·72	[illegible]	1·685	10,086	[illegible]	[illegible]
Dr Gilbert's meadow	„ 23-26	12	19,600	31·[illegible]	7·67	1·340	6,247	[illegible]	[illegible]
Park and Grass-walk	„ 26	11	13,620	27·30	7·44	1·628	3,723	277	[illegible]
Park and Lodge Meadow	July 2	20	27,330	[illegible]	8·14	1·670	7,446	[illegible]	[illegible]
	Total	72	101,960	...	...		27,502	2216	[illegible]
Second Crop Clover.									
Thirty acres	August 22	35	32,405	39·27	8·14	2·620	12,727	1,036	[illegible]
	„ 23	10	8,363	24·36	9·05	2·435	2,037	184	[illegible]
	„ 25	3	3,880	19·63	11·01	2·907	762	84	[illegible]
	„ 25	1	2,031	19·41	10·02	2·775	394	[illegible]	[illegible]
Geescroft	„ 25	2	2,090	19·88	9·06	2·649	415	38	[illegible]
	„ 25	2	2,160	19·01	9·13	2·269	411	[illegible]	[illegible]
	„ 25	2	2,005	19·50	10·90	2·557	391	42	[illegible]
	„ 25	1	1,040	18·36	9·40	2·798	191	18	[illegible]
	„ 26	5	5,790	21·90	9·15	2·524	1,268	116	[illegible]
Thirty acres	„ 26	7	7,216	32·67	7·97	2·639	2,358	188	[illegible]
	Total	68	66,985	...	...		20,954	1,784	[illegible]
	Brought from Silo 1	1	1,136	(19·43)	(9·28)	(2·618)	221	21	14
	Total	69	68,121	...	...	...	21,175	1,805	[illegible]
Second Crop Meadow-Grass.									
Park and Park Field	October 17	17	14,858	38·13	9·04	1·990	5,665	512	[illegible]
Summary.									
First crop grass		72	101,960	...	...	...	27,502	2,216	[illegible]
Second crop clover		69	68,121	...	...	...	21,175	1,805	[illegible]
Second crop grass		17	14,858	...	...	...	5,665	512	[illegible]
	Total	158	184,939	...	...	...	54,342	4,533	1,0[illegible]
	Tons, cwt.	82 11½		...	...	...	24 5¾	2 0¼	[illegible]

and that of the second-crop clover ranged from over 18 to over 39 per cent. Indeed, more than two-thirds of the clover put into the Silo No. 2 averaged nearly 36 per cent. dry matter. It is thus seen that the herbage put into Silo No. 2 contained a very much less proportion of water than that put into Silo No. 1. It was, in fact, upon the whole, riper, and doubtless more woody, especially so far as the meadow-grass was concerned.

ABLE IV.—*Quantity and Composition of the Herbage put into Silo No. 2; of the Silage taken out; and Actual and Percentage Loss of Constituents in the Silo.*

	Fresh.	Dry Matter.	Ash.	Nitrogen.	Dry Organic.	Crude Nitrogenous Substance = N × 6·25.	Crude Non-Nitrogenous Substance.	Water.
	Herbage as put into the Silo.							
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
…d crop grass	14,858	5,665	512	107	5,153	669	4,484	9,193
…d crop clover	68,121	21,175	1,805	552	19,370	3,450	15,920	46,946
…t crop grass	101,980	27,502	2,216	438	25,286	2,738	22,548	74,478
Total	184,959	54,342	4,533	1,097	49,809	6,857	42,952	130,617
	Silage taken out of the Silo.							
…ond crop grass	14,473	5,068	525	91	4,543	568	3,975	9,405
…ond crop clover	65,670	20,651	1,809	551	18,842	3,444	15,398	45,019
…st crop grass	90,798	23,361	2,086	369	21,275	2,306	18,969	67,437
Total	170,941	49,080	4,420	1,011	44,660	6,318	38,342	121,861
	Actual Loss of Constituents.							
…ond crop grass	385	597	+ 13	16	610	101	509	+ 212
…ond crop clover	2,451	524	+ 4	1	528	6	522	1,927
…st crop grass	11,182	4,141	130	69	4,011	432	3,579	7,041
Total	14,018	5,262	113	86	5,149	539	4,610	8,756
	Loss per Cent.—Total of each Constituent = 100.							
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
…ond crop grass	2·6	10·5	+2·5	15·1	11·8	15·1	11·4	+2·3
…ond crop clover	3·6	2·5	+0·2	0·2	2·7	0·2	3·3	4·1
…st crop grass	11·0	15·1	5·9	15·8	15·9	15·8	15·9	9·5
Total	7·6	9·7	2·5	7·8	10·3	7·8	10·7	6·7
	Loss per Cent.—Total Fresh = 100.							
…ond crop grass	2·6	4·0	+0·09	0·11	4·1	0·7	3·4	+1·4
…ond crop clover	3·6	0·8	+0·006	0·001	0·8	0·009	0·8	2·8
…st crop grass	11·0	4·1	0·1	0·07	3·9	0·4	3·5	7·0
Total	7·6	2·8	0·06	0·04	2·8	0·3	2·5	4·7

The great difference in the composition of the various crops put into the silos renders it extremely difficult to determine with certainty the changes and the losses which take place in them. There is also considerable difficulty arising from the depth of the silage in the pits, and the necessity of taking it out in several separate layers, and occupying weeks, or it may be months, in the process. The experience gained

this first year will probably enable us the better to guard against some of these possible sources of error in the future.

The columns of Table III (p. 16), giving the percentages of ash and of nitrogen in the dry matter of the herbage put into Silo No. 2, show that, whilst in the first crop of grass the ash varied from $7\frac{1}{4}$ to $8\frac{1}{2}$ per cent., and in the second crop of grass it was about 9 per cent., in the second crop of clover it varied from about 8 to about 11 per cent. of the dry matter. There is a still greater difference in the percentages of nitrogen in the dry matter of the two descriptions of herbage. Thus, whilst in the dry matter of the meadow-grass, the nitrogen ranged from 1·34 to 1·89 per cent., in that of the clover it ranged from 2·27 to 2·91 per cent.

Turning now to Table IV (p. 17) it is seen that the proportion of water lost in the silo was comparatively small, both in the meadow-grass and in the clover. The loss was in fact much less than in Silo No. 1. The crops put into the Silo No. 2 contained, it is true, a much less proportion of water than those put into Silo No. 1. But the amount of loss by fermentation was much greater, and hence it would be supposed that the greater heat developed would have caused more evaporation. It would seem, therefore, as was supposed, that part of the greater loss of water in Silo No. 1 was due to drainage, and part to the length of time taken in using the silage, and the consequent long exposure of the cut surfaces. In the second crop of clover in Silo No. 2 the loss of water indicated is only 4·1 per cent., whilst in the second crop of clover in the Silo No. 1 it amounted to over 20 per cent. Further, it will be observed that there was an actual gain of water by the second crop of grass, which formed the top layer in Silo No. 2, it having doubtless absorbed watery vapour from the layers below it.

The table (IV) shows that the losses of dry substance, and of its several organic constituents, were much greater, both in the first crop of grass which was at the bottom of the silo, and in the second crop of grass which was at the top, than in the clover between them. Of the 21,175 lbs. dry substance in the clover put into the silo, there was a loss of only 524 lbs., or of only 2·5 per cent.; whilst in the first crop grass below it there was a loss of 15·1 per cent., and in the second crop grass above it, a loss of 10·5 per cent. of the dry matter put in.

Of mineral matter, or ash, the figures show a gain in the second crop grass, and in the second crop clover, but a loss in the first crop grass. An examination of the ashes of the herbage put in, and of the silage taken out, clearly shows that, as before assumed, the irregularity is dependent on the variable amounts of adventitious mineral matter in the ashes.

Of the total nitrogen, the loss in the first crop of grass below the

clover was 15·8 per cent., and in the second crop grass above the clover it was nearly the same, namely, 15·1 per cent.; whilst in the clover itself, between them, the percentage of nitrogen in which is so much higher, the loss of it was extremely small, amounting to less than a quarter of 1 per cent.

Thus, contrary to what might have been expected, the results indicate much more loss of dry matter, and of its several constituents, in the meadow-grass than in the clover. Further reference to the various changes and losses will be made when we come to consider the chemical composition of the herbage put in, and of the silage taken out of the silos. It is obvious that, so far as the results of these first experiments are to be relied upon, the losses of the food-constituents of the crops are far less than in the German experiments before referred to.

4.—The Chemical Composition of the Silage.

Although a very large amount of analytical work has been executed in connection with our ensilage experiments, the data at present at command are insufficient to enable us to discuss at all adequately the changes, and the losses, which have taken place in the herbage put into the silo. Still, the results do bring to view some points of interest respecting which there can be little doubt.

Confining attention on the present occasion to Silo No. 1, it may be stated that, of the herbage put in, nine different mixed samples were made of the first-crop red-clover, and seven of the second-crop red-clover, as chaffed and put into the silo. Each of these samples represents the number of loads, and the weight of herbage, as shown in Table I, page 11; and is a mixture of a given quantity taken from each individual load. Unfortunately, the pressure of other work in the Rothamsted Laboratory rendered it quite impossible to determine the composition of these mixed samples in the green, undried condition. Each was, however, carefully sun-and-air dried; and in each, the dry matter, the ash, and the total nitrogen, were determined at Rothamsted. In proportionally mixed samples, representing, respectively, the whole of the first crop, and the whole of the second crop, the amounts of total nitrogen, of albuminoid nitrogen, and of woody fibre, have also been determined. The analyses of these mixed samples are, however, incomplete, but we are able to give, further on, a general indication of their bearing.

The first crop of clover put into the silo formed a layer of silage of 13 feet 10 inches in depth; and the second crop clover above it a layer of 4 feet of silage.

This latter, the second crop clover-silage, was taken out in one layer

to its full depth; and six samples were taken from it, namely—on December 13, 15, 18, and 30, 1884, and January 2 and 7, 1885. In each of these, the dry matter, the ash, and the total nitrogen, were determined at Rothamsted; and of three of them, namely, those taken on December 13, 18, and 30, more complete analyses were made by Dr. John A. Voelcker.

The first crop clover-silage was taken out in four layers, respectively of 4 feet 2 inches, 4 feet, 5 feet, and 8 inches, in depth. From the first layer five samples, namely, on January 14, 17, 20, 23, and 28, were taken; from the second layer five samples were taken, namely, on February 2, 6, 10, 17, and 19; from the third layer six samples were taken, namely, on March 6, 12, 14, 18, and 26, and April 4; and from the fourth layer five samples, namely, on March 10, 13, 17, and 20, and April 2. In each of these first crop clover-silage samples, the dry matter, the ash, and the total nitrogen, were, as before, determined at Rothamsted; and more complete analyses were made by Dr. John A. Voelcker, of the samples of January 17 and 23, of the first layer; of February 6 and 17 of the second layer; and of March 12 of the third layer. It was intended that another complete analysis of the silage of the third layer, and at least one of that of the fourth layer, should have been made, but this has not been accomplished.

Tables V and VI (pp. 21 and 22) give the results of the three complete analyses of the second-crop clover-silage, and of the five of the first-crop clover-silage; and, in the lower part of each table, is given a summary showing, side by side with Dr. Voelcker's determinations of dry matter, ash, and nitrogen, those made at Rothamsted in the same samples. Table V shows the percentage composition of the silage in the moist condition in which the samples were taken; and Table VI shows the percentage composition of the dry substance of the silage.

It will be seen that, upon the whole, Dr. Voelcker's and the Rothamsted determinations of dry matter, and of nitrogen, in the silage, agree very closely. Dr. Voelcker's determinations of mineral matter, or ash, are, however, always higher than those made at Rothamsted; the difference being probably due to the fact that, in the Rothamsted ashes, all visible adventitious matter was carefully picked out, whilst this was not done in the case of Dr. Voelcker's ashes.

It is frequently assumed that, although there is more or less loss of certain food-constituents in the conversion of succulent herbage into silage, yet this is more than compensated by the conversion of indigestible into digestible matter. The results at present at our command certainly do not seem to bear out this view.

ALYSES OF THE SILAGE FROM SILO NO. 1; FIRST AND SECOND CROP RED CLOVER; COMPLETE ANALYSES BY DR. J. A. VOELCKER; PARTIAL ANALYSES MADE AT ROTHAMSTED.

TABLE V.—*Per Cent. in Fresh Silage. Detailed Analyses of each Layer.*

Constituents.	2nd Crop Red Clover. Depth of Silage 4 feet.				1st Crop Red Clover. 1st depth, 4 feet 2 inches.		2nd depth, 4 feet.		3rd depth, 5 feet.	Mean.
	Sample 1 taken Dec. 13, 1884.	Sample 2 taken Dec. 18, 1884.	Sample 3 taken Dec. 30, 1884.	Mean.	Sample 1 taken Jan. 17, 1885.	Sample 2 taken Jan. 23, 1885.	Sample 1 taken Feb. 6, 1885.	Sample 2 taken Feb. 17, 1885.	Sample 1 taken Mar. 12, 1885.	
	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.
ter..	78·39	79·17	78·30	78·62	76·24	76·49	73·84	73·88	73·82	74·85
ble Albuminoids	0·12	0·44	0·49	0·35	0·31	0·50	0·88	0·75	0·56	0·60
uble Albuminoids	1·94	1·75	1·69	1·79	1·81	1·81	1·93	1·75	2·19	1·90
Total	2·06	2·19	2·18	2·14	2·12	2·31	2·81	2·50	2·75	2·50
ble Ash	1·28	1·37	1·28	1·31	1·45	1·40	1·88	1·69	1·58	1·60
uble Ash	0·76	0·64	0·75	0·72	0·67	0·69	0·71	0·88	0·78	0·75
Total	2·04	2·01	2·03	2·03	2·12	2·09	2·59	2·57	2·36	2·35
stible Fibre	5·37	5·29	5·51	5·39	5·93	6·13	6·56	7·06	6·45	6·42
dy Fibre	7·02	6·41	6·15	6·53	6·72	6·70	6·48	6·50	6·67	6·61
Total	12·39	11·70	11·66	11·92	12·65	12·83	13·04	13·56	13·12	13·03
ic acid	0·44	0·19	0·62	0·42	0·56	0·76	0·63	0·70	0·73	0·68
ic acid	0·86	1·18	0·85	0·96	1·10	0·84	1·11	0·79	0·81	0·93
Total	1·30	1·37	1·47	1·38	1·66	1·60	1·74	1·49	1·54	1·61
ble Carbohydrates, ides (1), Chlorophyll, &c.	3·82	3·56	4·36	3·91	5·21	4·68	5·98	6·00	6·41	5·66
Total of all	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
inoid Nitrogen	0·33	0·35	0·35	0·35	0·34	0·37	0·45	0·40	0·44	0·40
n-albuminoid Nitrogen	0·21	0·17	0·20	0·19	0·17	0·22	0·23	0·26	0·28	0·23
Total	0·54	0·52	0·55	0·54	0·51	0·59	0·68	0·66	0·72	0·63

Summary.

al y ter. Voelcker	21·61	20·83	21·70	21·38	23·76	23·51	26·16	26·12	26·18	25·15
Rothamsted *	21·38	20·44	21·62	21·15	23·84	22·74	25·00	25·29	25·15	24·40
Rothamsted †	21·82	20·63	22·24	21·56	24·40	23·50	25·63	25·99	25·88	25·08
al in h. Voelcker	2·04	2·01	2·03	2·03	2·12	2·09	2·59	2·57	2·36	2·35
Rothamsted	1·92	1·81	1·93	1·89	2·02	1·90	2·36	2·44	2·11	2·17
al gen sh. Voelcker	0·54	0·52	0·55	0·54	0·51	0·59	0·68	0·66	0·72	0·63
Rothamsted	0·56	0·53	0·57	0·55	0·54	0·54	0·65	0·67	0·69	0·62

* Actual result by drying at 100° C. † Actual result + volatile (acetic) acid.

ANALYSES OF THE SILAGE FROM SILO NO. 1; FIRST AND SECOND CROP RED CLOVER.

COMPLETE ANALYSES BY DR. J. A. VOELCKER; PARTIAL ANALYSES MADE AT ROTHAMSTED.

TABLE VI.—*Per Cent. in Dry Matter. Detailed Analyses of each Layer.*

	2nd Crop Red Clover.				1st Crop Red Clover.				
	Depth of Silage 4 feet.				1st depth, 4 feet 2 inches.		2nd depth, 4 feet.		3rd depth, 5 feet.
	Sample 1 taken Dec 13, 1884	Sample 2 taken Dec. 18, 1884.	Sample 3 taken Dec 30, 1884.	Mean	Sample 1 taken Jan. 17, 1885.	Sample 2 taken Jan. 2[illegible],	Sample 1 taken Feb. 6, 1885.	Sample 2 taken Feb. 17, 1885.	Sample 1 taken Mar [illegible], 1885.
	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.	P. cent	P. cent.	P. cent.	P. cent.
Soluble Albuminoids	0·56	2·11	2·26	1·64	1·30	2·13	3·36	2·87	2·14
Insoluble Albuminoids	8·97	8·40	7·79	8·39	7·62	7·70	7·38	6·70	8·37
Total	9·53	10·51	10·05	10·03	8·92	9·83	10·74	9·57	10·51
Soluble Ash	5·92	6·58	5·90	6·13	6·10	5·96	7·19	6·47	6·[illegible]
Insoluble Ash	3·52	3·07	3·46	3·35	2·82	2·93	2·71	3·37	[illegible]
Total	9·44	9·65	9·36	9·48	8·92	8·89	9·90	9·84	9·01
Digestible Fibre	24·85	25·40	25·39	25·21	24·96	26·07	25·08	27·03	24·64
Woody Fibre	32·48	30·77	28·34	30·53	28·28	28·50	24·77	24·89	25·48
Total	57·33	56·17	53·73	55·74	53·24	54·57	49·85	51·92	50·12
Acetic Acid	2·04	0·91	2·86	1·94	2·36	3·23	2·41	2·68	2·71
Lactic Acid	3·98	5·67	3·91	4·52	4·63	3·57	4·24	3·02	3·09
Total	6·02	6·58	6·77	6·46	6·99	6·80	6·65	5·70	5·[illegible]
Soluble Carbohydrates, Amides (1), Chlorophyll, &c	17·68	17·09	20·09	18·29	21·93		22·86	22·97	24·[illegible]
Total of all	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Albuminoid Nitrogen	1·53	1·68	1·61	1·61	1·43	1·57	1·72	1·53	1·68
(1) Non-albuminoid Nitrogen	0·97	0·82	0·92		0·72	0·94		1·00	1·07
Total	2·50	2·50	2·53	2·61	2·15	2·51	2·60	2·53	2·75

Summary.

Total Dry Matter.	Voelcker	21·61	20·83	21·70	21·38	23·76	23·51	26·16	26·12	26·16
	Rothamsted*	21·28	20·44	21·62	21·15	23·84	22·74	25·00	26·29	25·16
	Rothamsted †	21·82	20·68	22·24	21·56	24·40	23·30	25·63	25·99	25·[illegible]
Total Ash in Dry Matter.	Voelcker	9·44	9·65	9·35	9·48	8·92	8·89	9·90	9·84	9·01
	Rothamsted	8·80	8·77	8·68	8·75	8·28	9·09	9·21	9·30	8·15
Total Nitrogen in Dry Matter.	Voelcker	2·50	2·60	2·54	2·61	2·15	2·51	2·60	2·53	2·75
	Rothamsted	2·55	2·35	2·07	2·56	2·21	2·30	2·54	2·57	2·65

* Actual result by drying at 100° C. † Actual result + volatile (acetic) acid.

The percentage of "*woody fibre*" is considerably higher in the dry substance of the silage than it was found to be in that of the herbage put in; and, so far as the results enable us to calculate, there was no reduction in the total amount of woody fibre put into the silo. The differences in the percentages of woody fibre in the different samples of silage which the analyses show, might, at first sight, lead to the conclusion that there has been a reduction in its percentage, and in its amount, in the lower layers; and the results might further be supposed to indicate a somewhat corresponding increase in the soluble extractive matters (soluble carbohydrates, &c.). But a careful consideration of the differences in the condition of maturation, and in the composition accordingly, of the herbage contributing to the several layers of silage, shows that the differences in the composition of the latter in these respects, are obviously connected with differences in the character of the herbage put in.

As to the relative proportions of soluble and insoluble albuminoids in the silage, it is obvious that they, too, are largely dependent on the conditions of succulence, or of ripeness, of the herbage put in; though some of the results seem to favour the view that a portion of the insoluble albuminoids has become soluble. According to the results given in Table II (p. 12), there was a loss of about 8 per cent. of the total nitrogen of the herbage put into the silo; and the analytical results now given show that, of the total nitrogen in the silage from the first crop clover, there was an average of 36·8 per cent. in a non-albuminoid condition; whilst initiative results show that, in the herbage put in, less than 20 per cent. of the total nitrogen was non-albuminoid. Again, of the total nitrogen of the second-crop clover-silage, there was an average of 36 per cent. non-albuminoid; whilst in the very ripe herbage put in, only about 10 per cent. of the total nitrogen was non-albuminoid. These results are quite in accordance with those obtained by Professor Kinch, Mr. Clifford Richardson, the late Dr. Voelcker, Mr. W. H. Jordan, and others.

Thus, not only is there a loss of nitrogenous food-material, but a very considerable proportion of the nitrogenous substance which remains is degraded into compounds, some of which are of no value as food (ammonia for example), whilst others, forming a much larger proportion, are, to say the least, of reduced food-value. Further, besides the loss, and the degradation, of nitrogenous substance, it has been shown that there was also more or less loss of non-nitrogenous matter; whilst there is no evidence that woody fibre of a certain degree of induration has been rendered more soluble.

It remains to see what are the results of the experiments on the feeding of animals with the silage.

5.—Experiments with Fattening Oxen.

In the beginning of December, 1884, 10 oxen were selected from a herd of 40 Irish shorthorns, of good quality, which cost about 16*l.* a head delivered at Rothamsted a short time previously. On December 19th, they were weighed, and divided into two lots of five each; care being taken that the two lots should correspond as far as possible, both as to the character of the animals, and in weight. The difference in the average weight per head of the two lots, was, at the commencement of the experiment, only 12 lbs. For the purpose of the experiment they were placed in ten boxes under the same roof; one lot of five facing the other lot of five.

The experiment was arranged to compare the feeding value of red-clover-silage with that of an ordinary winter food for fattening stock—namely, a mixture of clover-hay-chaff and swedes. Besides these foods, which were to be tried one against the other, each animal received the same description and amount of purchased or saleable food; namely, 6 lbs. of cake, and 4½ lbs. of barley-meal, per head per day. Of the experimental foods, one lot received an average of rather more than 65 lbs. of clover-silage per head per day; and the other lot 12 lbs. of clover-hay-chaff, and an average of about 50 lbs. of swedes, per head per day. As far as we could calculate beforehand, the quantity of dry substance in the silage given to the one lot, would be nearly the same as that in the clover-hay and swedes given to the other lot.

Table VII (p. 25) shows the exact amounts of the various foods consumed per head per day by each lot. In the particulars of the foods weighed off it will be noticed that some cake was included. This consisted of the harder pieces of decorticated cotton-cake, which has been unusually hard of late. It would have been better to have picked this out, and weighed it separately. It will be seen, however, that the oxen on silage had more than 75 lbs. of the mixed foods per head per day, of which, on the average, only about 1½ lb. was weighed off. Reckoning one-fourth of this to have been cake and three-fourths silage, and that of the food weighed off from Lot 2, one-third was cake, one-third chaff, and one-third swedes, calculation shows that the silage oxen consumed about ½ lb. more dry substance of food per head per day than the others; but this larger amount of dry substance contained a somewhat larger proportion of woody fibre. The total amount of dry substance consumed was, in both cases, on the average, between 24 and 25 lbs. per head per day; and the quantity of nitrogen consumed was practically identical in the two cases.

EXPERIMENTS ON THE FEEDING OF OXEN.

TABLE VII.—FOOD CONSUMED PER HEAD PER DAY.

Lot 1.—5 *Oxen; Experimental Food—Clover Silage.*

Food given per Head per Day.

Periods.	Clover-silage.	Cake.*	Barley meal.
	lbs.	lbs.	lbs.
cember 19—December 31 = 13 days.	65	6	4½
uary 1—February 10 = 41 „ .	70	6	4½
bruary 11—March 16 = 34 „ .	65	6	4½
rch 17—April 11 = 26 „ .	65	5	4½
Total.............114 days.	—	—	—

Food Weighed off.

nuary 7	20 lbs.	Chiefly silage.
nuary 26	90 „	Chiefly silage.
bruary 10	168 „	Silage and cake.
bruary 20	92 „	Silage and cake.
bruary 28	124 „	Silage and cake.
rch 9	38 „	Chiefly silage.
rch 16	116 „	Silage and cake.
ril 9	78 „	Chiefly silage.
ril 11	57 „	Silage and a little cake.
Total	783 lbs.	Per head per day 1·36 lb.

Lot 2.—5 *Oxen; Experimental Food—Clover-chaff and Swedes.*

Food given per Head per Day.

Periods.	Clover-chaff.	Swedes.	Cake.*	Barley meal.
	lbs.	lbs.	lbs.	lbs.
cember 19—December 31 = 13 days.	12	40	6	4½
nuary 1—January 7 = 7 „ .	12	60	6	4½
nuary 8—March 16 = 68 „ .	12	50	6	4½
arch 17—April 11 = 26 „ .	12	50	5	4½
Total............ 114 days.	—	—	—	—

Food Weighed off.

nuary 7	35 lbs.	Chaff and swedes.
rch 16	85 „	Chaff, swedes, and cake.
rch 23	46 „	Chaff and swedes.
ril 11	34 „	Chaff, swedes, and cake.
Total	200 lbs.	Per head per day .... 0·35 lb.

* December 19 to February 4 (48 days) an equal mixture of linseed and decorti-ed cotton-cake; February 5 to April 11 (66 days) decorticated cotton-cake only.

The following Table (VIII) shows the weight of each animal at the commencement, at two intermediate periods, and at the conclusion of the experiment; also the gain in weight within each period, and over the total period of 16 weeks and 2 days. It further shows, for each lot, and for each period, the average increase per head per week, and the average increase per 1000 lbs. live-weight per week.

Taking the results for the whole period, whether we compare the total increase, the average increase per head, the increase per head per week, or per 1000 lbs. live-weight per week, there is a very close agreement between the two lots, the one receiving clover-silage, and the other very nearly the same amount of dry substance in clover-hay-chaff and swedes. The silage has slightly the advantage; but the difference is not more than might be expected in two lots of oxen fed on precisely the same food. Both lots did remarkably well; the silage oxen giving an average increase of rather more, and the others of rather less, than 1½ per cent. of their live-weight per week. There can be

Experiments on the Feeding of Oxen.

Table VIII.—*Actual Weights, and Increase in Weight of the Oxen.*

Oxen.	Actual weights.				Increase in weight.			
	Dec. 19, 1884.	Jan. 30, 1885.	Feb. 28, 1885.	April 11, 1885.	Dec. 19 to Jan. 30, 43 days.	Jan. 30 to Feb. 28, 29 days.	Feb. 28 to April 11, 42 days.	Total Dec. 19 to April 11, 114 days.
Lot 1.—5 Oxen; Experimental Food—Clover-silage.								
Nos.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	1055	1145	1183	1281	90	38	98	226
2	1132	1330	1421	1547	198	91	126	415
3	1086	1224	1263	1344	138	39	81	258
4	1048	1213	1260	1365	165	47	105	317
5	1020	1171	1253	1351	151	82	98	331
Total	5341	6083	6380	6888	742	297	508	1547
Average	1068	1217	1276	1378	149	59	102	310
Increase per head per week					24·3	14·2	17·0	19·0
Increase per 1000 lbs. live-weight per week					21·2	11·4	12·8	15·6
Lot 2.— Oxen; Experimental Food—Clover-chaff and Swedes.								
1	1055	1231	1265	1347	176	34	82	292
2	1068	1229	1260	1327	161	31	67	259
3	1020	1166	1186	1288	146	20	102	268
4	1125	1257	1270	1393	132	13	123	268
5	1132	1334	1390	1519	202	56	129	387
Total	5400	6217	6371	6874	817	154	503	1474
Average	1080	1243	1274	1375	163	31	101	295
Increase per head per week					26·5	7·5	16·8	18·1
Increase per 1000 lbs. live-weight per week					22·8	5·9	12·7	14·8

doubt, therefore, that well made red-clover-silage is a very good ›d for fattening oxen.

About 25 years ago, from the results then at command, we conıded that fattening oxen, liberally fed on good food, composed of a ›derate proportion of cake or corn, some hay or straw-chaff, and ots, would, on the average, consume 12 to 13 lbs. of the dry subınce of such mixed food per 100 lbs. live-weight per week, and ould give 1 lb. of increase in live-weight for 12 or 13 lbs. dry subınce of food so consumed; that is 1 per cent. increase in live-weight r week. In these new experiments the oxen receiving silage consumed ther over, and those receiving clover-chaff and swedes rather under, lbs. of dry substance of food per 100 lbs. live-weight per week; d the former gave 1 lb. increase for a little over 9 lbs., and the ter for about 9⅓ lbs. dry substance of food consumed. In other rds, both lots consumed rather more dry substance of food per) lbs. live-weight per week than according to our former estimates; t they gave considerably more increase, both upon a given liveight within a given time (about 1½ instead of 1 per cent. per week), d for a given amount of dry substance of food consumed.

It will be seen that the amount of cake and meal given was rather ge, together amounting to 10½ lbs. per head per day. It was, hower, thought desirable that the fattening should be completed, or arly completed, when the experiment closed. It is a question how the better result than formerly is due to the large proportion of ce and meal; how far to improvement in the fattening qualities of ›ck since that time; and how far to the fact that, with earlier ıturity, the increase in live-weight represents a considerable prortion of growth as well as fattening increase. It may be added that ır of the oxen were sold by auction at Watford, and fetched *l.* 6*s.* 3*d.* per head; whilst the others were sold at intervals during en weeks, and averaged 24*l.* 12*s.* 6*d.* per head.

So far then as the results of a single experiment can be relied upon, ould seem that, as food for fattening oxen, a given amount of dry stance in red-clover-silage is quite equal to the same amount of substance in a mixture of clover-hay-chaff and swedes, given in proportion of 12 parts chaff to 50 parts swedes.

will be of interest to consider—what would be the difference in cropping of the farm, to produce clover-silage on the one hand, or er-hay-chaff and swedes, on the other, in the proportions used in e experiments with oxen. Supposing that, to give a herd of 65 lbs. of clover-silage per head per day, we had to produce tons of the silage; and for the 12 lbs. of clover-hay and lbs. of swedes, per head per day, we had to produce 12 tons clover-hay, and 50 tons of swedes—how much land would be

required in the two cases? A fairly good crop of red clover, cut twice, would weigh about 10 tons per acre in the green or fresh state; and according to the results with No. 1 Silo, this would yield only about 7½ tons of clover-silage, so that it would require 8⅔ acres to produce the 65 tons of silage. The 10 tons of first and second crop green clover would make about 2½ tons of clover-hay; so that it would require about 4¾ acres to produce the 12 tons of clover-hay. There would thus remain about 4 acres at disposal for the production of the 50 tons of swedes.

6.—Food Required for mere Sustenance, for the Production of Milk, and for the Production of Fattening Increase.

Before referring to the plan and the results of the experiments with cows, it may be well, with a view to the better understanding of the subject, to make some remarks on food generally, and especially to call attention to the distinction between the amount of food required for the mere sustenance of the animal, and the amount required for the production of the milk.

In the various accounts which have been published of experiments on silage, nothing is more striking than the extraordinary results which are stated to have been obtained by its use. In several cases, the use of an amount of the material which, according to calculation, would not contain more dry substance of food than would be sufficient to support the life of the cow, has, it has been stated, been followed by a remarkable increase in the production of milk and butter. The authors of these statements have, probably, no doubt of their accuracy; but they depend upon others for the record of the facts; and those employed usually try to make these come out so as to meet the views of their masters, if they take an interest in the new food.

The ordinary dry foods of the farm—hay, straw, and corn—contain about one-sixth of their weight of water, and five-sixths of real *dry substance*. Whenever the foods given to cows have been carefully weighed, and the dry matter determined, it has been found that a cow of ordinary size, and in ordinary milking condition, will consume not less than 25 lbs. of "*dry substance*" of food daily.

For example, 40 years ago, Drs. Thomas and Robert Dundas Thomson carried out some feeding experiments at Glasgow, with cows of the Ayrshire breed, weighing about 1000 lbs. each. They used grass alone, or hay, with various dry foods. The cows were yielding about 2 gallons (about 20⅝ lbs.) of milk per head per day, and the dry substance of food varied from 25 lbs. to 30 lbs. per head per day. The higher amount, which was that consumed when an additional

ıntity of corn or linseed was given, yielded only a slight increase the milk.

About 25 years ago we conducted experiments with cows and ən, at Rugby, for the Royal Sewage Commission, trying unwaged against sewaged grass, and the same with oilcake in lition. The various experiments were made in 1861, 1862, and 63. We will confine attention here to the experiments with cows. e average weight of the animals was between 1000 and 1100 lbs. e average of five experiments with grass alone—some unsewaged l some sewaged—showed that 28·7 lbs. of dry substance of food re consumed per head per day, with an average yield of 26½ lbs. of lk per head per day. And the average of five experiments with ıss and oilcake showed a consumption of 28·4 lbs. of dry substance of d per head per day, with a yield of 25½ lbs. of milk per head per day.

Again, in the course of experiments which we conducted for the ard of Trade on the relative values of unmalted and malted barley, food for stock, cows, oxen, sheep, and pigs were experimented on; and in the case of the 20 cows, of which the average weight s 1140 lbs., and the average yield of milk about 23 lbs. per head day, the average consumption, over a period of 10 weeks, during winter of 1863–4, amounted to about 29½ lbs. dry substance of d per head per day.

In 1884, we assisted Mr. Edwards, who has a large dairy of ghly-bred shorthorns at St. Albans, in carrying out some experints upon ensilage; and it was found, on calculation, that, in the three periments, the food supplied 28½ lbs., 27 lbs., and 27 lbs., per head day, of real *dry substance*; whilst the three lots were yielding, pectively, an average of 19¾ lbs., 17 lbs., and scarcely 17 lbs. of milk, head per day. It may be mentioned that these were unusually ıvy cows, one indeed weighed over 1700 lbs., and the 26 cows ve an average of 1413 lbs.

Again, in the spring of 1884, the dry food consumed by the thamsted cows, when yielding 30 lbs. of milk per head per day, s about 26 lbs.

It is usually said that it requires about three acres of grass to support cow for a year. If we estimate an acre of ordinary meadow land, ıen fed or mown, to yield a produce equal to 1½ tons of hay per re, three acres of such produce would furnish a cow with an average lbs. of *dry substance* of food per day during the year; if the proce were equal to 1¾ tons of hay per acre, 3 acres would supply an erage of 26·8 lbs. of *dry substance* per day for a year; or if the yield re equal to 2 tons of hay per acre, it would supply an average of ·7 lbs. of *dry substance* of food per day, the year round. The ıd would of course yield much more than its average quantity

during the summer, and much less during the winter; whilst a cow would consume more than its average amount when yielding milk, and less when dry.

It will be seen that there is a fairly general agreement between the figures brought out in the foregoing cases; certainly quite sufficient, not only to raise doubts as to the accuracy of any results which differ materially from them, but also sufficient to provide practical farmers with some basis upon which to calculate the requirements of their stock during the six winter months.

So far, we have only treated of the amount of dry substance of food consumed by a cow that is yielding milk. It is evident, however, that the different foods must vary considerably in their composition, and consequently in their feeding qualities, as also they vary in their cost; and as, in all dairies, the yield of milk varies considerably, not only according to the milk-yielding capacity of the individual cows, but also owing to the necessary fluctuations in the yield from the time of calving to dryness, an accurate knowledge of the feeding qualities of different descriptions of food ought to lead to economy in their use.

For many years past, important investigations have been carried on in Germany, especially at Weende, by Henneberg and others, relating to the digestibility of the various constituents contained in different foods, and also as to the amounts of the digestible substances which are required to support life.

What is called the "sustenance food" of an animal, is the amount which will supply the waste of the body in a state of rest, without either gain or loss of weight. For example, it was found that a ration of 19½ lbs. of clover hay supplied to an ox weighing 1000 lbs., was sufficient to keep up this weight, without adding to it, the animal doing no work, and the temperature of the stall being kept at about 51° Fahrenheit. Of this 19½ lbs. of hay, $\frac{5}{8}$ lb. of nitrogenous, and nearly 7¾ lbs. of non-nitrogenous substances, were digested. Other rations were also experimented upon—such as clover hay, straw, and rape cake, in different proportions, and clover hay, mangels, straw, and rape cake. The mean of five experiments, including that with the clover hay alone, showed 0·57 lb. of digestible nitrogenous, and 7·4 lbs. of digestible non-nitrogenous substances, to be required for the support of the animal without gaining or losing weight; but in two of the cases the temperature of the stall was about 62° F., and in the other two it was about 69° F. From results of this kind, both Professor Julius Kühn and Professor Emil v. Wolff have constructed tables which give the amounts of digestible substances that may be expected to be present in a great variety of foods.

Owing to the great difference in the feeding qualities of the same description of food—whether it be roots, hay, corn, or purchased food—it is evident that these tables require to be used with caution; still, when so used, they are of considerable value. We now propose, therefore, to apply them to the results obtained at Rothamsted in the spring of 1884, from 30 cows, each of which consumed daily 4 lbs. decorticated cotton-cake, 3½ lbs. bran, 3·6 lbs. hay chaff, 7·2 lbs. oat-straw chaff, and 81 lbs. mangels, and yielded 30 lbs. of milk per head per day.

The following Table (IX) shows that the food supplied an average of about 25¾ lbs. dry substance per head per day. It also gives the quantities of digestible nitrogenous and non-nitrogenous substances in the foods, calculated according to our own estimates of average composition, and to Emil v. Wolff's estimates of the proportion of the several constituents which is digestible. It further shows—the amounts which, according to the German estimates, would be required for the sustenance of one of the cows, the average weight of which was about 1290 lbs.; the amounts required for the production of 30 lbs. of milk; and lastly, the estimated excess in the food.

TABLE IX.—*Amount and Distribution of Food, and Food Constituents, per Head per Day.*

	Total dry substance.	Digestible.		
		Nitrogenous substance.	Non-nitrogenous substance.*	Total, nit. and non-nit.-substance.
	lbs.	lbs.	lbs.	lbs.
4 lbs. cotton-cake	3·6	1·38	1·93	3·31
3½ lbs. bran	3·0	0·42	1·41	1·83
3·6 lbs. hay chaff	3·0	0·19	1·52	1·71
7·2 lbs. oat-straw chaff	6·0	0·10	2·86	2·96
81 lbs. mangels	10·1	1·30	7·40	8·70
	25·7	3·39	15·12	18·51
Required for sustenance of 1290 lbs. live-weight	—	0·74	9·55	10·29
		2·65	5·57	8·22
Required for 30 lbs. of milk	—	1·10	3·90	5·00
Estimated excess in food	—	1·55	1·67	3·22

* Reckoned as starch.

Of the $25\frac{3}{4}$ lbs. of dry substance of food consumed, about $18\frac{1}{8}$ lbs. are reckoned as digestible ; and of the non-nitrogenous or respiratory and fat-forming portion of the food, about $9\frac{1}{2}$ lbs. out of the $15\frac{1}{8}$ are estimated to be employed in supporting the life of the animal. It is, however, probable that somewhat more than this was actually used for the purpose, as the temperature of our sheds would be lower than in the cases of the German experiments above referred to. Thus, whilst for the mere sustenance of the cow the demand upon the non-nitrogenous constituents of the food is very large, the requirement for the nitrogenous constituents is small.

In the case of all the foods except the roots, only that portion of the nitrogenous and non-nitrogenous constituents which is estimated to be digestible is entered in the table; but as regards the mangels all the constituents are included, as the German calculations do not make any allowance for indigestible matter in their case. It is generally assumed, however, that it is only those compounds which contain nitrogen in the form of albuminoids that are competent to form flesh and the nitrogenous compounds of milk; whilst it is certain that a very large proportion of the nitrogen in roots is not in that form. In connection with ensilage this subject becomes of great importance, as there seems to be no doubt that during the fermentation much of the albuminoid matter is destroyed.

It will be observed that of the 10·1 lbs. of dry substance of the mangels, 1·3 lb. is given as digestible nitrogenous matter ; but of this total quantity as little as one-fifth may, and pretty certainly not more than two-fifths would, consist of albuminoids. Out of the 10·1 lbs. of total dry substance, 7·4 lbs., or about 74 per cent., are recorded as digestible non-nitrogenous, or respiratory and fat-forming matter. We thus see what constitutes the great value of the root-crops. It is the fact that they furnish the essential respiratory constituents of food in very large quantities; though, even when grown under very favourable conditions of soil and season, they are not adapted for fattening, unless used in conjunction with other foods. For the purpose of mere sustenance however—as, for instance, in the case of cows which are out of milk, but are kept in warm yards or sheds—roots are a very suitable food used with straw chaff.

It may here be mentioned incidentally, that the loss of lambs born dead, which is often attributed to the manure used for the roots, is more probably due to the want of sufficient albuminoids in the roots. It should be further understood that while the nitrogenous constituents of the food can be used by the animals for respiratory purposes, the non-nitrogenous constituents cannot be used for the production of albuminoids; and as a certain amount of albuminoids is essential, if the food is deficient in them the animal must wastefully consume the

non-nitrogenous substances in excess in order to obtain enough of the albuminoids.

The quantities given in the table are calculated for a cow weighing 1290 lbs.; but if as many sheep as would represent an equivalent weight were substituted for the cow, the amount of sustenance food necessary to keep them without increasing or losing weight, would be considerably higher; partly because more surface would be exposed to the cold; and partly because there is always more or less growth of wool.

Out of the 15½ lbs. of total digestible non-nitrogenous, or respiratory and fat-forming matter in the food, the home produce of the farm furnished rather more than 11¾ lbs., and the purchased cake and bran about 3½ lbs.; and as the sustenance of the animal is reckoned to require only about 9½ lbs., there remains a surplus of 2¼ lbs. of the home produce, and all the respiratory constituents of the purchased food, available for the production of milk or increase. Instead of the 9½ lbs. required by the cow for sustenance, sheep of the same weight would probably require the whole of the digestible non-nitrogenous substance of the farm-produce for sustenance alone; and they would be entirely dependent upon the purchased food for increase in live-weight.

It has been shown that the food requirements of a cow for the purposes of sustenance only, are very small so far as the nitrogenous constituents are concerned, but large for the respiratory, or non-nitrogenous matters. For a cow yielding 30 lbs. (nearly 3 gallons) of milk per day, however, the requirement for the nitrogenous constituents is very much greater. Foods which are rich in nitrogen, such as oil-cakes and leguminous seeds, are therefore specially adapted for the production of milk.

It is somewhat remarkable that the composition of bran, which has special value in the eyes of all dairy-men, bears a very close relation to that of milk in the proportion of the digestible nitrogenous and non-nitrogenous constituents, as will be seen in the following table:—

	Digestible nitrogenous matter.	Digestible non-nitrogenous matter.
3½ lbs. of bran will supply....	0·42	1·41
11½ „ of milk will contain....	0·42	1·49

Table IX (p. 31) shows that, in the 4 lbs. of cake and 3½ lbs. of bran, which were daily supplied to the cows, the total digestible constituents would be approximately the same as those required to produce the 30 lbs. of milk; but the nitrogenous would be in excess, and the non-nitrogenous in about corresponding deficiency. As, however, the

amount of milk varies very much, owing to the difference in the milk-yielding capacity of different cows, and as every cow, whatever its capacity may be, has a maximum yield which is followed by an almost daily decline, it appeared desirable, while the ensilage experiments were going on, that the cake and bran, which obviously contributed so largely to the production of the milk, should be supplied to each cow somewhat in proportion to its yield.

The following Table (X) shows, not only how very large, but how very variable, may be the amounts of total solid matter, nitrogenous matter, fat, &c., in the milk yielded by different cows, or even by the same cow at different periods between calving and dryness. For comparison there is also given, the estimated composition of the increase in live-weight of a fattening ox weighing 1000 lbs., the amount of which increase would frequently be only about 10 lbs., and would rarely exceed 15 lbs. per week.

The table shows the amounts of the various solid constituents in the milk yielded per week by cows giving respectively 4, 8, 12, 16, and 20 quarts per day = 7, 14, 21, 28, and 35 gallons per head per week, assuming the milk to contain 12·50 per cent. of total solids; consisting of 3·65 per cent. albuminoids, 3·50 per cent. butter-fat, 4·60 per cent. sugar, and 0·75 per cent. mineral matter. The table also shows, the estimated constituents in the weekly increase in live-weight of a fattening ox weighing 1000 lbs.:—

TABLE X.

Milk per week (one gallon reckoned to weigh 10·33 lbs.).	Total solid matter.	Nitrogenous substance.	Fat.	Non-nitrogenous substance not fat.	Mineral matter.
	lbs.	lbs.	lbs.	lbs.	lbs.
7 gallons...........	9·04	2·64	2·53	3·33	0·54
14 "	18·08	5·28	5·06	6·66	1·08
21 "	27·12	7·92	7·59	9·99	1·62
28 "	36·16	10·56	10·12	13·32	2·16
35 "	45·20	13·20	12·65	16·65	2·70
10 lbs. increase in live-weight..........	7·25	0·75	6·35	—	0·15
15 lbs. increase in live-weight..........	10·88	1·13	9·53	—	0·22

It may be observed that whilst the meat-producing power of an ox is confined within comparatively narrow limits, the milk-producing capacity of a cow has a very wide range. Another very remarkable fact is the extremely small amount of both nitrogenous and mineral

matter which is stored up in the increase of an ox, compared with that carried off in the milk of a cow. Hence, a dairy, where milk is exported, is very exhausting.

It is evident that there is far more scope for economy in the regulation of the diet of a cow producing milk, than in that of a fattening ox. During the period in which an ox advances from the store condition to fatness, at an average rate of increase which may be estimated at from 1 to 1½ per cent. of its live-weight per week, a cow may be yielding 5 gallons of milk per day at one time, and at another less than one-fourth of that quantity.

Starting with the fact that the two lots of 20 cows each, which were under experiment, were receiving, per head per day, 4 lbs. of cake, and 3½ lbs. bran, with a fixed amount of chaff, and, in addition, in one case silage, and in the other roots, and were yielding an average of 28 lbs. of milk per head per day, it was decided that whilst each lot of 20 cows should continue to receive the total of 80 lbs. of cake daily, the amount should be so apportioned among the 20 that each cow should receive more or less than 4 lbs. daily, accordingly as its yield during the preceding week averaged more, or less, than 28 lbs. of milk per day. The average yield of milk of each cow was, therefore, made up at the end of the week; and, for the succeeding week, 4 lbs. of cake were given to every cow which had yielded 28 lbs. of milk daily: and to each cow which yielded more or less than this quantity, the amount of cake was increased, or reduced, in the proportion of ¼ lb. of cake for each 2 lbs. of milk yielded more or less than 28 lbs.

Thus, if a cow yielded 50 lbs. of milk per day (nearly 5 gallons), that is 22 lbs. more than the standard amount of 28 lbs., it received an extra allowance of 2¾ lbs. of cake, or in all 6¾ lbs. per day; if it yielded 40 lbs. (nearly 4 gallons) or 12 lbs. in excess of the average, it received 1½ lb. cake extra, or a total of 5½ lbs.; if 30 lbs., or 2 lbs. extra, in all 4¼ lbs. cake; if only 20 lbs., or 8 lbs. deficiency, only 3 lbs. of cake; or if only 10 lbs., or 18 lbs. deficiency, it received 2¼ lbs. less cake, or in all only 1¾ lb., and so on.

We cannot at present discuss the results of this experiment; but anyone who looks at the table showing the difference between the amount of solid matter contained in 7 gallons and in 35 gallons of milk, will admit that, without some regulation of the diet, one of two things must take place. Either the yield of some cows must be stinted for want of sufficient food, or others must be receiving food which cannot be turned to profitable account. The highest average yield of milk of any cow during our experiments was 51 lbs., or nearly 20 quarts per day, whilst several were yielding, at the same time, not much more than one-fifth of this quantity.

It is no unusual thing to give fattening oxen 15 lbs. to 18 lbs. of

cake and corn per day. An ox receiving this quantity of food must be consuming a very large amount of nitrogenous substance, of which but a very small percentage is found in the increase in live-weight. A certain amount of that which is digested may be employed in the production of fat, the nitrogen being found in the urine in soluble compounds. In this form, however, the nitrogen nitrifies so rapidly in the soil, that it has little more permanence as manure than that in a salt of ammonia, or in nitrate of soda.

On the other hand, the bulk of the manure of a fattening ox possesses a durability which is well established in practice. Indeed, it may be considered that "condition," or "unexhausted fertility" of a soil, is chiefly due to the constituents of the food which pass, with but little change, in the solid excrements of the fattening animals; but partly also to those in the litter. To *accumulate* nitrogen in the soil, it must be in combination with carbon. In a field where we grow barley continuously, manured with rape cake, although the cake largely increases the crop, a residue still accumulates in the soil, sufficient to be measurable by analysis, and so to establish a claim for unexhausted fertility.

7.—Preliminary Experiments with Milking Cows.

In the beginning of February, 1884, one of the laboratory staff was instructed to take the weight of each cow's milk, morning and evening, and to ascertain the amount of food consumed. This was before a brick of the silos was laid, but in anticipation of experiments which it was intended to carry out in the following winter.

From the 4th of February to the 9th March, the average yield of milk per cow per day was 29 lbs. 13 oz., and the average consumption of food per head per day was estimated to be as follows:—

Decorticated cotton cake..............	4	lbs.
Bran	3½	,,
Mixed hay and straw chaff	14	,,
Mangels	80	,,

The fluctuations in the average daily yield of milk were very small, the highest of any one day being just below 32 lbs., and the lowest a little above 27 lbs. The weights of food were not, however, taken with sufficient accuracy to be altogether reliable, as will be evident from the results obtained in the following month, when it was found that between March 10th and April 7th the average yield of milk was 30 lbs. 5 oz. The same amounts of cake and bran were consumed, but of chaff it was found, on accurate weighing (instead of measuring), that the consumption amounted to only 10½ lbs. per cow,

or 3½ lbs. per head per day less than the amount estimated to be given in the previous month. The amount of dry substance of food consumed per cow daily was now 25¼ lbs., whilst the figures for the previous month would give 28¼ lbs.; but it is probable that not more than from 25 lbs. to 26 lbs. of dry substance was really consumed.

The grass was so forward on April the 8th, that the cows were turned out from 11 o'clock to 3 o'clock each day. This was continued until the 17th, during which time they had the same cake and bran as before, but only about half the amount of chaff and rather less mangels. On April 17 they were turned out altogether; but continued to have the same quantity of cake; the bran, chaff, and mangels, being gradually reduced; the two latter being stopped altogether in the middle, and the bran at the end of May. The average yield of milk only increased slightly, the amount being 31¾ lbs. as against 30¼ lbs.; and the highest increase during the summer was to 35 lbs. 3 oz. in the week ending May 17th.

It does not appear that, if cows have been well fed during the winter, any large increase of milk is obtained when they are turned out to grass; and later on, when the weather became hot and dry, the milk fell off very much, the flies having been very troublesome during part of the time. With the exception of the cotton cake, 4 lbs. of which were given to each cow daily, no record of food consumed was possible until the cows again went into their winter quarters in November, but in the meantime the milk was carefully weighed.

8.—Plan and Arrangement of the Experiments with Milking Cows.

In the beginning of December, 1884, 48 cows were in milk, 40 standing in one house—20 facing the other 20—the food being supplied from a gangway down the centre. We proposed to try only two experiments; and after much trouble in calculation, and finding it hopeless to match each individual cow in one lot with one in the other which had been approximately the same length of time in milk, and was yielding the same amount of milk, it was finally decided to select from the herd two lots, of 20 each, which should agree as nearly as possible in the following conditions: (1) the *average* number of weeks since calving; (2) the *average* yield of milk. This involved the shifting of some of the cows—a proceeding which they strongly resented. Eventually two lots of 20 each were selected, which gave between 14 and 15 weeks as the average date since calving, and an average daily yield of milk of between 30 lbs. and 31 lbs. during the preceding 10 weeks; or less, if they had not been in milk so long.

Of course these averages were made up of very great differences, both in the length of time since calving, and in the yield of milk;

but such is the case in all herds where it is of importance to obtain, as nearly as possible, an uniform supply of milk all the year round. As the experiments were to go on for some months, it was evident that, in both lots, some cows would become dry, and would have to be replaced by others which had recently calved. Still it was considered that results obtained under these circumstances were far more likely to be trustworthy than if the experiment had been made on individual, or on a very few, cows.

Although a certain amount of interest attaches to the substitution of silage for hay, it will be admitted by every practical farmer, that the real value of silage must greatly depend upon its capability of wholly, or at any rate largely, superseding root-crops. To those who are out of the reach of brewer's grains, roots are the only succulent food available for fully half the year; and it is tolerably evident that, without some succulent food, neither meat nor milk can be produced profitably during the winter months.

As already shown, in the experiments with fattening oxen, clover-silage was tried against a mixture of clover-hay-chaff and swedes; but in the experiments with milking cows, now to be described, the comparison is limited to the trial of silaged crops against mangels.

In arranging comparative feeding experiments, it is always desirable that those foods which are not the subject of comparison should be the same for the different lots of animals. Silage, and especially that made from red clover, with which we began our experiment, differs from roots in some important respects. It contains a much higher percentage of dry substance, its dry substance contains a considerably higher proportion of albuminoid compounds, and also very much more indigestible woody fibre. It was impossible, therefore, so to arrange the two rations as to supply exactly the same constituents in each; and it was decided that equal quantities of *dry substance* should be given in the silage, and in the mangels.

The following amounts of other foods were allotted per head per day to each of the 40 cows:—

Cake	4	lbs.
Bran, 3½ lbs., afterwards raised to	4	„
Chaff (half hay and half straw)	10	„

Thus far the same foods were given to each lot; but, in addition, one lot received, per head per day, at first 42 lbs. of clover-silage, gradually raised to 50 lbs., and the other lot at first 75 lbs. of mangels, gradually increased to 90 lbs., as the silage given to the others was increased, and it was found that lower down in the pit it contained a higher percentage of dry matter. Most of the cows took to the silage readily, though a few had a distinct aversion to it, and in order not to

influence their yield of milk injuriously these were supplied with a limited quantity of mangels as well as silage, the former being reduced and the latter increased until their repugnance to the food had ceased.

Two or three weeks elapsed before the disturbance caused by the necessary changes in the position of some of the cows, and in the alteration of their food, was overcome; and it was not until the 24th of December that the animals were weighed.

9.—The Results of the Experiments with Milking Cows.

Table XI (p. 41) shows the average amounts of food consumed per head per day, by each lot of 20 cows, within each of the 13 weeks of the experimental period.

Table XII (pp. 42–3) shows, for each of the 20 cows receiving clover-silage, and Table XIII (pp. 44–5), for each of the 20 receiving mangels, the dates of calving, the average yield of milk per day prior to the commencement of the experiment, and the average yield during each of the 13 weeks of the experimental period. They also show, the average yield per day, and the total yield, both in lbs. and gallons, of each cow, over the whole of the experimental period.

Milking cows are exceedingly sensitive to change in anything they have been accustomed to; and after the few necessary transpositions of the animals had been made in accordance with the allotments, and the experiment had fairly commenced, they were treated exactly as if they had not been under experiment at all; the only difference in the management being that both the food and the milk were carefully weighed. Several of the cows of each lot became dry during the experiment; and they were replaced by others, as explained in the foot notes to Tables XII and XIII. The results proved that the new cows were not all equally good milkers; but the differences are to some extent neutralised by the large number of animals in each lot.

Table XI (p. 41), relating to the food, shows that during the first few weeks, until the animals had become accustomed to the silage, a small quantity of mangels was given with it; and this was done again towards the end of the experiment, in the case of a few cows which did not consume all their silage, when it was found that, with the admixture of a small quantity of mangels, they generally consumed their silage also. Most of the animals, however, took to the silage quite readily.

At page 35, it was stated that each lot of 20 cows received the same total amount of cake and bran, but that, after a time, first the cake, and afterwards the bran also, were allotted to the individual cows within each lot in proportion to their yield of milk. That is to

say, instead of each cow receiving 4 lbs. of cake, and 3½ lbs. or 4 lbs. of bran, it received more or less than these quantities, in proportion as its yield of milk was more or less than the average of the whole lot. We shall consider the results of this apportionment of the purchased foods according to the yield of milk at some future time.

Tables XII and XIII show that, over the whole experimental period of 13 weeks, the average yield of milk of the cows receiving clover-silage was 25 lbs. 12 ozs. per head per day, against 27 lbs. 5 ozs., yielded by the cows receiving mangels. This corresponds to a difference over the whole period of 14 gallons per head, or of 281 gallons in the lot of 20 cows, in favour of those receiving mangels.

It is probable that part of this difference was due to the fact that two of the cows brought into the mangel lot during the progress of the experiment (Nos. 21 and 40), turned out to be much better milkers than any two brought into the silage lot. But it is probable that it was also in part due to the more succulent mangels being a more appropriate addition to the dry food for milking cows, than so much silage, which contained nearly twice as high a percentage of dry substance as the mangels. That this was so would appear from the fact that the cows on the silage drank an average of about 1¾ gallon more water per head per day than those on the mangels.

Upon the whole the evidence points to the conclusion that if a portion of the dry matter of the clover-silage, say one-fifth or more, had been replaced by a corresponding amount in mangels, not only would some of the cows have consumed the silage better, but such a mixture would doubtless have been more appropriate for milk-yielding. It was feared, however, that if a mixture of the two foods to be compared were given, the results might not be sufficiently distinct. It may be added that the general impression among the attendants was that the cows on the clover-silage showed more tendency to fatten than the others; whilst, as a matter of fact, they did give rather more increase in live-weight. To this point we shall recur further on.

It will be seen that the anticipation we expressed that there would be considerable difficulty in getting strictly comparable results in experiments with dairy cows has been fully realised. But, as the whole of the data are now before the reader, he can form his own conclusions respecting them.

EXPERIMENTS WITH COWS.

Table XI.—Average Food Consumed per Head per Day.

13 Weeks; December 14, 1884, to March 14, 1885.

Week ending	Average food given per head per day.					Total food weighed off.
	Cake.*	Bran.	Chaff.	Clover-silage.†	Mangels.‡	
Lot 1.— 20 Cows; Experimental Food—Clover-silage.						
1884-5.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Dec. 20 §	4	3½	6¾	42⅛	13¾	410½
„ 27 §	4	3½	9⅛	44⅜	8⅝	0
Jan. 3 §	4	3½	10	46⅞	4¼	0
„ 10	4	3½	10	48⅝	(3) 13⅞	0
„ 17	4	3½	10	50	0	0
„ 24	4	3½	10	50	0	0
„ 31	4	3½	10	50	0	0
Feb. 7	4	3½	10	50	0	0
„ 14	4	3½	10	50	0	0
„ 21	4	3½	10	50	(1) 5¾	0
„ 28	4	3¾	10	50	(2) 7⅛	415
Mar. 7	4	4	10	50	(2) 2⅞	307
„ 14	4	4	10	50	0	353
Per head per day	—	—	—	—	—	0¾
Lot 2.—20 Cows; Experimental Food—Mangels.						
1884-5.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Dec. 20 ‖	4	3½	11	—	75	—
„ 27 ‖	4	3½	10⅞	—	75¾	—
Jan. 3	4	3½	10	—	80	—
„ 10	4	3½	10	—	80	—
„ 17	4	3½	10	—	82⅞	—
„ 24	4	3½	10	—	90	—
„ 31	4	3½	10	—	90	—
Feb. 7	4	3½	10	—	90	—
„ 14	4	3½	10	—	90	—
„ 21	4	3½	10	—	90	—
„ 28	4	3¾	10	—	90	—
Mar. 7	4	4	10	—	90	—
„ 14	4	4	10	—	90	—
Per head per day	—	—	—	—	—	—

* December 14 to January 5, half linseed, and half decorticated cotton-cake; afterwards decorticated cotton-cake only.

† Second-crop clover-silage, December 14 to January 10; afterwards first-crop clover-silage.

‡ First three weeks some mangels were supplied to all the silage-fed cows; the figures in parentheses show the number of cows receiving mangels at other periods.

§ Averages for 19 cows only; cow No. 19 various foods.

‖ Averages for 19 cows only; cow No. 35 various foods.

EXPERIMENTS

TABLE XII.—YIELD OF MILK

Lot 1.—20 Cows.

Names of cows.	Date of calving.	First milked.	Average milk per head per day. Prior to experiment. From calving.		Previous 10 weeks (or less).		Last week (or less).		Experimental period. Week ending Dec. 20.		Dec. 27.		Jan. 3.	
	1884.	1884.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
1. Strawberry......	Oct. 28	Oct. 29	47	13	(48	10)	45	11	40	3	39	1	38	13
2. Phœbe*	Mar. 31	Apr. 5	36	7	17	11	12	8	11	11	11	14	11	8
3. Isabella†	Sept. 2	Sept. 3	22	5	20	6	19	2	17	12	16	8	16	12
4. Penelope.......	Aug. 19	Aug. 21	29	8	25	13	20	7	19	12	20	7	20	7
5. Beauty‡	June 6	June 10	29	11	23	6	18	12	16	6	16	6	16	0
6. Joan of Arc.....	Sept. 29	Oct. 1	33	5	33	10	29	15	25	7	24	1	24	1
7. Rothamsted Maid	Sept. 23	Oct. 1	24	3	23	9	16	12	16	0	16	1	16	2
8. Parody	Nov. 2	Nov. 5	39	11	(40	0)	38	7	35	15	34	11	33	0
9. Queen Bess	Aug. 17	Aug. 21	32	0	29	2	21	15	23	2	22	14	22	1
10. Cherry Ripe.....	Oct. 17	Oct. 21	45	3	(45	14)	41	2	37	14	36	3	35	5
11. Granny	Aug. 18	Aug. 19	26	7	24	13	20	3	20	12	20	12	19	13
12. Helen	Nov. 18	Nov. 19	35	3	(36	12)	35	6	29	7	34	0	31	5
13. Polly	June 19	June 20	36	14	28	0	22	3	20	12	21	6	21	9
14. Sally	Nov. 20	Nov. 21	39	11	(41	15)	41	1	36	2	41	2	44	3
15. Wonder§	July 22	July 23	21	10	19	6	14	15	13	1	14	14	13	14
16. Fairy Queen‖....	Feb. 24	Feb. 26	36	0	23	8	20	4	18	5	17	14	18	1
17. Buttercup.......	Oct. 2	Oct. 4	32	12	32	10	35	0	32	5	33	0	30	0
18. Narcissus¶......	June 22	June 24	22	10	16	10	10	8	6	10	2 28	12 7	33	15
19. Lucy	Dec. 9	Dec. 13	(37	8)	(37	8)	(37	8)	33	3	40	11	43	6
20. Victoria†	Sept. 9	Sept. 10	39	3	37	5	30	0	26	3	26	14	26	15
	Average		33	6	30	5	26	9	24	1	25	8	25	12

* Replaced January 11th, by Ann, calved January 3rd.

† Bought as newly-calved at this date; exact date of calving not known.

‡ Replaced February 5th, by Gypsy, calved January 30th; Gypsy (ill) replaced February 16th, by Rosemary, calved February 12th.

TH COWS.

HEAD PER DAY (LBS).

perimental Food—Clover-silage.

10.	Jan. 17.	Jan. 24.	Jan. 31.	Feb. 7.	Feb. 14.	Feb. 21.	Feb. 28.	Mar. 7.	Mar. 14.	Average per day.	Total yield.	
oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs. oz.	lbs.	galls.
2	36 13	35 6	36 9	36 5	35 4	34 10	33 7	33 4	31 11	35 15	3271¾	317
5	35 4	37 1	39 11	38 6	38 1	36 2	36 6	35 13	33 3	28 14	2624⅞	254
6	16 7	15 11	15 11	15 9	15 14	15 8	15 12	15 12	15 4	16 1	1461¾	142
5	19 11	19 6	19 8	19 7	19 0	18 8	17 13	15 15	15 8	18 13	1712⅛	166
8	14 1	13 8	12 12	12 1 14 11	13 7	17 15 28 15	32 13	33 4	33 4	19 11	1794	174
12	21 8	21 11	21 0	19 12	19 15	19 15	19 5	18 13	18 1	21 3	1926⅛	186
8	15 5	14 13	14 2	13 15	13 7	12 15	12 9	11 14	11 4	14 2	1287¾	125
9	33 5	33 8	33 3	33 8	32 0	31 7	31 0	30 6	29 13	32 10	2970⅛	287
8	21 13	20 11	19 14	18 15	18 1	16 15	15 15	14 13	12 12	19 4	1750⅛	169
14	33 9	32 11	32 13	32 0	31 12	31 2	31 6	31 6	31 2	33 3	3017⅛	292
13	17 11	16 15	17 10	18 5	16 15	15 5	13 10	14 15	14 2	17 6	1579⅛	153
4	31 6	29 8	27 12	28 8	27 11	28 9	26 11	26 14	25 2	29 3	2653⅛	257
11	21 3	20 15	20 5	20 10	20 3	20 4	20 1	19 14	19 7	20 9	1871	181
10	44 5	44 0	44 15	45 10	46 2	46 13	44 1	44 10	43 12	43 11	3978⅛	385
7	12 13	12 2	12 12	13 9	13 4	13 10	14 1 17 0	20 6	21 4	14 11	1335¼	129
15	19 2	19 6	18 10	19 4	19 8	19 10	18 13	18 15	17 8	18 11	1701⅛	165
6	32 11	32 7	33 15	32 12	32 9	33 10	32 12	33 0	32 13	32 8	2956	286
4	34 10	35 1	34 0	31 15	30 4	30 15	28 9	24 11	24 11	28 6	2580⅛	250
8	43 10	44 7	43 13	43 3	44 1	44 12	44 6	42 14	42 10	42 8	3865⅛	374
13	28 13	28 6	29 9	28 14	28 11	28 2	28 7	27 0	25 5	27 12	2526⅛	245
2	26 11	26 6	26 7	26 3	25 13	26 4	26 0	25 12	24 15	25 12	2343¼	227

§ Replaced February 25th, by Daffodil, calved February 20th.

‖ Slipped calf October 15th, but continued milking.

¶ Replaced December 23rd, by Kate, calved December 20th.

EXPERIMENT

TABLE XIII.—YIELD

Lot 2.—20 Co

Names of cows.	Date of calving.	First milked.	Average milk per head per day. Prior to experiment. From calving.		Previous 10 weeks (or less).		Last week.		Experimental period. Week ending Dec. 20.		Dec. 27.		Jan. 3.	
	1884.	1884.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.
21. Susan*	June 12	June 14	28	5	18	4	11	7	10	1	8	7	[illegible]	[illegible]
22. Countess	Nov. 23	Nov. 28	45	8	(45	7)	46	1	44	10	41	10	[illegible]	[illegible]
23. Nina	Oct. 31	Nov. 8	37	0	(37	0)	34	10	32	5	31	1	[illegible]	[illegible]
24. Jane	Nov. 29	Nov. 30	23	15	(24	0)	27	5	29	9	28	8	[illegible]	[illegible]
25. Charmer	Aug. 30	Sept. 3	36	8	33	2	26	1	24	12	23	15	[illegible]	[illegible]
26. Nancy†	Sept. 9	Sept. 10	30	15	28	5	21	10	13	15	13	2	[illegible]	[illegible]
27. Nelly	Dec. 2	Dec. 6	39	12	(41	0)	41	0	40	15	39	1	[illegible]	[illegible]
28. Princess‡	April 29	May 5	22	8	17	5	13	1	12	7	10	9	[illegible]	[illegible]
29. Bright Eye	June 17	June 23	32	10	28	0	25	15	25	4	23	15	[illegible]	[illegible]
30. Darling..........	July 5	July 5	34	12	29	6	23	8	21	13	21	0	[illegible]	[illegible]
31. Empress.........	Oct. 18	Oct. 21	40	6	(40	12)	37	0	38	12	38	3	[illegible]	[illegible]
32. Julia	Nov. 16	Nov. 17	27	0	(29	4)	34	10	30	15	32	13	[illegible]	[illegible]
33. Scrutable	Nov. 3	Nov. 5	35	15	(36	6)	33	9	31	3	29	15	[illegible]	[illegible]
34. May Day	July 4	July 5	27	4	22	7	21	11	22	7	22	6	[illegible]	[illegible]
35. Liddy..........	Dec. 11	Dec. 14	—		—		—		32	12	43	0	[illegible]	[illegible]
36. Welcome	Nov. 24	Nov. 28	45	12	(46	3)	46	5	47	13	47	3	[illegible]	[illegible]
37. Ne plus ultra§...	July 1	July 5	30	15	23	6	20	5	20	6	21	1	[illegible]	[illegible]
38. Cowslip‖	April 1	April 4	31	9	21	4	15	13	18	4	15	14	[illegible]	[illegible]
39. Russet Belle ...	March 18	March 20	38	9	27	9	21	0	19	14	19	4	[illegible]	[illegible]
40. Ophir¶	July 26	August 1	34	1	28	6	20	3	19	3	17	10	[illegible]	[illegible]
	Average		33	14	30	6	27	7	26	14	26	7	[illegible]	[illegible]

* Replaced January 11th, by Dewdrop, calved January 6th.

† Bought as newly-calved at this date; exact date of calving not known. Rep February 22nd, by Gypsy, calved January 30th. (See Note ‡, Lot 1).

‡ Replaced January 24th, by Emma, calved January 2nd.

H COWS.

PER HEAD PER DAY (LBS.).

imental Food—Mangels.

	Average milk per head per day.																			Summary for experimental period. 13 weeks, Dec. 14—Mar. 14.			
	Experimental period.																						
	Week ending																			Average per day.		Total yield.	
.	Jan. 17.		Jan. 24.		Jan. 31.		Feb. 7.		Feb. 14.		Feb. 21.		Feb. 28.		Mar. 7.		Mar. 14.					
oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	galls.
8	51	10	48	14	51	0	53	3	54	7	52	4	51	0	49	9	47	12	37	11	3432¾	332
15	38	7	40	10	40	2	39	12	39	3	37	4	38	14	38	2	38	12	39	10	3608¼	349
7	31	10	30	14	31	8	31	6	31	1	30	8	29	15	28	10	27	15	30	10	2789	270
10	31	11	30	12	30	8	31	3	31	2	31	0	30	15	29	13	28	12	30	5	2759⅞	267
4	21	12	20	11	20	7	20	12	20	3	21	1	20	3	19	3	19	8	21	6	1944¾	188
13	11	4	10	9	10	9	10	8	10	0	9	0	17	14	20	14	20	5	13	6	1216½	118
7	38	2	33	11	39	8	34	15	34	8	34	5	34	14	33	6	34	7	36	6	3298½	319
0	4	0	3 7	4 6	12	0	18	15	20	15	20	7	21	3	20	11	20	9	14	1	1279⅛	124
8	23	18	24	4	23	0	23	6	22	14	22	0	22	15	21	11	21	8	23	4	2115⅜	205
12	20	7	20	15	19	15	21	1	21	0	20	12	26	6	29	0	29	10	22	9	2054⅛	199
6	34	4	32	12	32	10	34	3	33	4	32	5	33	12	33	12	32	1	34	4	3116⅛	302
4	30	5	29	5	27	14	26	13	25	7	24	10	25	9	27	10	27	11	28	7	2589	251
14	26	0	25	5	23	11	24	10	22	12	22	12	22	4	21	13	21	14	24	14	2266⅛	219
4	21	4	21	4	19	8	19	11	20	5	19	14	19	0	18	1	17	6	20	7	1860¾	180
14	49	5	44	5	48	12	49	15	44	7	45	6	47	11	47	13	49	1	46	3	4201	407
9	40	13	39	10	35	10	35	12	35	14	34	2	32	12	30	0	29	11	37	13	3443⅛	333
1	17	7	15	7	12	5	10	14	34	5	36	8	35	10	37	0	34	11	24	3	2202½	213
14	6	0	5 11	8 0	20	5	23	10	23	7	22	12	21	13	21	9	20	10	17	7	1589½	154
14	16	14	16	13	16	10	15	15	16	4	16	3	14	15	15	10	15	14	17	1	1551½	150
14	13	8	12	4	11	3	9 29	14 11	43	12	44	12	47	6	47	0	48	3	26	14	2444¾	237
5	26	7	25	7	26	6	27	2	29	4	28	14	29	12	29	9	29	5	27	5	2488⅛	241

§ Replaced February 8th, by Butterfly, calved February 3rd.

|| Replaced January 24th, by Rose, calved January 1st.

¶ Replaced February 6th, by Milkmaid, calved February 4th.

We will next give the results obtained on changing from clover-silage to meadow-grass-silage:—

On March 14 the experiment with cows on clover-silage terminated, and that on meadow-grass-silage at once commenced, and was continued for a period of six weeks. In order not to interfere with the yield of milk by a sudden change of food, a mixture of three parts clover-silage and one part grass-silage was given during the first seven days, and a mixture of half clover- and half grass-silage during the next seven days, after which grass-silage only was given.

Table XIV shows the average amounts of the different foods consumed per head per day, within each week, by each of the two lots of 20 cows.

EXPERIMENTS WITH COWS.

TABLE XIV.—AVERAGE FOOD CONSUMED PER HEAD PER DAY. SECOND PERIOD; SIX WEEKS, MARCH 15 TO APRIL 25.

Week ending	Average food given per head per day.					Total food weighed off.
	Cake.	Bran.	Chaff.*	Silage.	Mangels.†	
Lot 1.—20 Cows; Part Clover-silage, part Meadow-grass-silage.						
1885.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
March 21	4	4	9 3/7	50	(1) 11 3/7	408
„ 28	4	4	8	50	(1) 20	197
April 4	4	4	7 5/7	50	(2) 20	829
„ 11	4	4	7	50	(4) 11 3/7	395
„ 18	4	4	7	42 1/7	(20) 6 3/7	434
„ 25	4	4	7	41 3/7	(20) 17 1/7	75‡
Average per head per day	..	..	..	..	..	2·19
Lot 2.—20 Cows; Mangels as before.						
March 21	4	4	10	—	90	—
„ 28	4	4	10	—	90	—
April 4	4	4	10	—	90	—
„ 11	4	4	10	—	90	40
„ 18	4	4	10	—	90	—
„ 25	4	4	10	—	90	—
Average per head per day	..	..	..	..	..	0·06

* ½ hay and ½ oat straw.

† The figures in parentheses show how many cows received mangels.

‡ During this period most of the unconsumed food was distributed among the other cows of the lot, and consumed.

It will be seen that both lots received the same amount of cotton-ıke and bran as before; and Lot 2 also the same amount of chaff and angels as before. In fact, there was no change whatever in the ›od of the 20 cows receiving mangels. The cows receiving silage ere also at first supplied with the same amounts of both chaff and lage as before; but they did not consume them, and it was found ›cessary to reduce the quantity of chaff, until, during the last three eeks of the period, the allowance was only 7 lbs. instead of 10 lbs. ›r head per day; and during the last fortnight the amount of silage as reduced by nearly one-fifth, and some mangels were given to all stead of only to a few, of the cows receiving silage. It will be ›served, indeed, that throughout the experiment a good deal of food, ıiefly silage and chaff, was left unconsumed.

In the case of the experiment with clover-silage as against mangels, was concluded that the silage, when given to cows in quantity con-ıining an amount of dry matter corresponding to that in the mangels, 'as not so suitable for milk production as the succulent mangels, rhich only contained about half the percentage of dry matter, and a ery much less proportion of woody fibre. It was also concluded ıat probably a better result would have been obtained if a smaller uantity of the silage, with some mangels, had been given. The ıeadow-grass-silage contained a still higher percentage of dry matter ıan the clover-silage, and no doubt a much higher percentage of 'oody fibre. It also contained only about two-thirds as much itrogen as the clover-silage; though the quantity of it consumed ›ntributed nearly as much nitrogen as the quantity of mangels con-ımed by the other cows; and doubtless the silage supplied a larger mount of albuminoid nitrogen than the mangels, that is, a larger mount in a condition available as food.

It is not to be wondered at, therefore, that with silage containing ;ill more dry matter, and especially still more woody fibre, the cows ıould not consume so much, and that they should also require much ›ss chaff.

Table XV (p. 48) shows, for each of the 20 cows receiving the ıeadow-grass-silage, the average yield of milk per day, during each of x weeks of the experiment; and Table XVI (p. 49) shows the same articulars for the 20 cows receiving mangels. In each case, there is lso given the average yield per day during the preceding 13 weeks f those of the cows which had gone through the whole of the revious experiment, or for a shorter period for those which had been rought in during its progress; also the average yield during the nmediately preceding week. Finally, there is given the average ield per day, and the aggregate yield (both in lbs. and in gallons), f each cow, and of each lot, during the whole period of six weeks f the second experiment

EXPERIMENTS WITH COWS.

TABLE XV.—YIELD OF MILK PER HEAD PER DAY, &c. SECOND PERIOD; MARCH 15 TO APRIL 25.

Lot 1.—20 *Cows; part Clover-silage and part Meadow-grass-silage 2 weeks; Meadow-grass-silage 4 weeks.*

Names of cows.	Yield of milk per head per day. Previous period. 13 weeks (or less) Dec. 14 to March 14.		Last week, March 8 to 14.		Experimental period. Week ending March 21.		March 28.		April 4.		April 11.		April 18.		April 25.		6 weeks, March 15 to April 25. Average per day.		Total yield.	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	galls.
1. Strawberry	35	15	31	11	30	15	28	15	27	7	24	10	23	2	24	11	26	10	1118⅛	108
2. Ann	(36	10)	33	3	33	5	33	4	32	6	30	12	31	6	31	7	32	1	1847⅜	130
3. Isabella*	16	1	15	4	14	1	12	4	10	2	9 / 40	9 / 0	42	2	41	9	23	1	969	94
4. Penelope†	18	13	15	8	14	4	12	3	9	10	7 / 20	14 / 13	22	2	21	13	15	4	636⅜	62
5. Rosemary	(32	5)	33	4	33	10	32	12	31	3	28	10	27	9	26	0	29	10	1257⅞	122
6. Joan of Arc	21	3	18	1	17	2	15	8	14	9	14	6	13	11	13	11	14	13	622⅛	60
7. Beatrice‡					35	1	38	3	35	12	29	14	34	8	35	12	34	14	1464⅛	142
8. Parody	32	10	29	13	29	5	27	14	27	11	26	5	26	2	27	8	27	8	1153⅞	112
9. Queen Bess§	19	4	12	12	10	15	8 / 26	8 / 2	31	9	35	7	35	2	35	10	26	10	1118⅜	108
10. Cherry Ripe	33	3	31	2	30	11	29	12	28	11	27	6	26	12	24	15	28	1	1177⅞	114
11. Granny‖	17	6	14	2	13	9	12	8	11	2	9	7	7 / 34	12 / 10	33	5	17	5	724⅛	70
12. Helen	29	3	25	2	25	2	25	8	24	8	21	11	18	2	18	5	22	3	942⅛	91
13. Polly	20	9	19	7	20	5	19	1	17	13	16	10	16	5	15	6	17	9	739	72
14. Sally	43	11	43	12	41	12	41	7	41	3	37	13	35	7	37	14	39	4	1648⅛	159
15. Daffodil	(19	15)	21	4	22	8	23	1	22	7	21	8	21	7	21	3	22	0	925⅛	90
16. Fairy Queen	18	11	17	8	16	15	15	10	15	11	15	4	15	3	14	15	15	10	655⅞	63
17. Buttercup	32	8	32	13	33	6	32	5	32	2	32	6	26	3	23	5	29	15	1258⅞	122
18. Kate	(30	13)	24	11	22	10	22	14	20	8	18	14	19	7	18	5	20	4	851	82
19. Lucy	42	8	42	10	42	12	45	9	45	11	37	10	34	13	39	3	40	15	1719⅜	166
20. Victoria	27	12	25	5	24	4	22	10	21	7	20	1	19	2	18	6	21	0	880⅜	85
Average	27	13	25	10	25	10	25	2	25	1	23	15	25	9	26	3	25	4	1060⅛	102

* Replaced April 10, by Princess, calved April 6.
† Replaced April 10, by Alice, calved March 28.
‡ Beatrice calved March 10, brought into the experiment on March 15.
§ Replaced March 28, by Defiance, calved March 19.
‖ Replaced April 18, by Caroline, calved April 10.

TABLE XVI.—YIELD OF MILK PER HEAD PER DAY, &c. SECOND PERIOD; MARCH 15 TO APRIL 25.

Lot 2.—20 Cows; Mangels as before.

Names of cows.	Yield of milk per head per day.																		6 weeks, March 15 to April 25.			
	Previous period.				Experimental period.																	
					Week ending																	
	13 weeks (or less) Dec. 14 to March 14.		Last week, March 8 to 14.		March 21.		March 28.		April 4.		April 11.		April 18.		April 25.		Average per day.		Total yield.	
	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	oz.	lbs.	galls.
21. Dewdrop	(50	7)	47	12	45	6	44	9	44	11	39	10	39	11	43	13	42	15	1803[illegible]	175
22. Countess	39	10	38	12	37	7	38	8	37	9	36	12	36	2	36	12	37	3	1561[illegible]	151
23. Nina	30	10	27	15	27	4	26	14	26	15	23	4	23	8	25	10	25	9	1074[illegible]	104
24. Jane	30	5	28	12	29	0	28	1	27	1	27	5	26	12	26	5	27	7	1151[illegible]	112
25. Charmer	21	6	19	8	17	10	16	14	16	6	15	0	14	1	13	3	15	8	651[illegible]	63
26. Gypsy	(19	11)	20	5	19	14	20	0	20	10	21	5	20	15	21	1	20	10	866[illegible]	84
27. Nelly	36	6	34	7	32	6	29	4	29	9	27	7	27	3	28	5	29	0	1218[illegible]	118
28. Emma	(19	0)	20	9	20	7	20	9	20	14	21	2	20	1	20	5	20	9	863[illegible]	84
29. Brighteye*	23	4	21	8	21	7	20	10	19	13	17	12	14	7	{8 {30	14} 6}	18	3	763[illegible]	74
30. Darling	22	9	29	10	28	0	28	5	25	13	27	4	27	13	27	10	27	8	1153[illegible]	112
31. Empress	34	4	32	1	32	3	32	13	31	15	32	0	33	0	31	2	32	3	1351[illegible]	131
32. Julia†	28	7	27	11	25	13	24	9	24	2	18	6	16	1	33	1	23	10	795[illegible]	77
33. Scrutable	24	14	21	14	20	12	20	10	19	12	19	10	19	8	19	7	19	15	837[illegible]	81
34. Mayday‡	20	7	17	6	16	0	15	7	15	10	13	13	{11 {40	10} 3}	38	14	19	4	575[illegible]	55
35. Liddy	46	3	49	1	46	0	45	0	45	6	44	7	45	7	44	6	45	2	1893[illegible]	183
36. Welcome	37	13	29	11	28	3	28	3	27	5	27	13	27	7	27	4	27	11	1163[illegible]	112
37. Butterfly	(35	10)	34	11	35	10	35	13	35	10	32	9	34	1	34	0	34	10	1453[illegible]	140
38. Rose	(21	13)	20	10	19	15	19	6	19	4	18	11	18	10	19	1	19	3	804[illegible]	78
39. Russet Belle	17	1	15	14	14	9	14	11	15	10	15	12	14	15	15	4	15	2	636[illegible]	62
40. Milkmaid	(45	5)	48	3	48	1	43	1	43	0	38	11	39	8	39	7	41	15	1762[illegible]	171
Average	30	4	29	5	28	5	27	11	27	6	25	15	25	12	27	15	27	3	1119	108

* Replaced April 24, 1885, by Sylvia, calved April 10, 1885.
† Replaced April 19, 1885, by Flora, calved April 18, 1885.
‡ Replaced April 18, 1885, by Phœbe, calved April 10, 1885.

In the first place, Table XV (p. 48) shows that, of the 20 cows on silage, four became dry during the experiment; one in the second, two in the fourth, and one in the fifth week, and they were replaced by others; three out of the four of which gave a higher yield of milk than the average of the lot. Table XVI (p. 49) shows that, of the 20 cows on mangels, three became dry, one in the fifth, and two in the sixth week; and they were in each case replaced by others which yielded more than the average of the lot.

In the week prior to the commencement of this second experiment, the average yield of the silage-fed cows was nearly 3¾ lbs. per head per day less than that of the cows on mangels; and although during the six weeks of the experiment the cows receiving the meadow-grass-silage gave a less actual quantity of milk than those on mangels, they fell off in yield less, and gave, on the average of the whole period, only 2 lbs. instead of as at the beginning nearly 3¾ lbs. less milk per head per day than the mangel-fed cows. Both lots fell off in yield during the fourth week, probably under the influence of the weather. But whilst the silage-fed cows recovered again in the next week, coincidently with a reduction in the amount of silage and its replacement by some mangels, aided by the introduction of fresh cows, those on mangels did not recover until a week later, and then not to their original yield, notwithstanding three high-yielding cows had been brought in.

So far as the yield of milk is concerned, the evidence is, therefore, not adverse to the silage, when used in moderate quantity, according to the amount of solid and digestible matter it contains.

In the first experiment, the cows receiving clover-silage in rather large amount gave rather less milk than those on mangels; but, on the other hand, they gave a considerable increase in live-weight, whilst those on mangels as a whole lost in weight. Owing to the numerous changes in the cows during the course of the experiments, it happens that there are only 12 of the original silage-fed cows, and only 11 of the original mangel-fed cows, the weights of which can be traced through both periods of experiment. The cows were weighed soon after the commencement of the experiment with clover-silage, in December, 1884; again at the end of that experiment, when that with the meadow-grass-silage commenced; and, lastly, at the conclusion of the second period. We do not propose to enter fully into the subject of the increase or loss in weight of the animals on the present occasion, but only to refer to the general character of the results in their connection with the greater or less yield of milk by the different lots, over the different periods.

As already said, the cows on clover-silage increased in weight con-

ırably, and of the 12 of the original 20 which continued through- both experiments, every one increased when on the clover-silage. the other hand, of the 11 of the mangel-fed cows which remained ughout the two periods, only 4 increased during the first period, on the average the lot lost in weight. During the second period, ever, when the meadow-grass-silage was used, only 3 of the 12 s increased at all, two of them very little, and the lot as a whole in weight considerably; whilst of the 11 cows of the mangel lot, w increased, and the lot as a whole increased in weight.

rom the whole of the results of the experiments on the feeding of s with silage, it would appear that the clover-silage given in such e quantity was more favourable for meat-production, and less for -production, than the mangels. On the other hand, when the dow-grass-silage was used, the animals did not give more milk, they lost in weight. There can be no doubt that the grass-silage inferior as food to the clover-silage; and it is to be supposed that favourable maintenance in the yield of milk on the grass-silage pared with that of the cows on mangels over the same period, is ny rate partly to be attributed to a drain on the flesh and fat pre- sly stored up by the animals. So far as this may take place, it ously does not necessarily follow that there will be an immediate ng off in the yield of milk on changing to an inferior food. It is wn that a badly-fed cow will reduce in condition very much when ling a calf; and the same thing may happen when the cow is ed. In fact, the comparative values of different foods for cows not be measured by the yield of milk alone; but the increase or in weight must also be taken into account.

—CHARACTER AND COMPOSITION OF THE MILK FROM THE DIFFERENT FOODS.

wing to the large amount of additional work in the Rothamsted oratory in connection with other branches of the ensilage experi- its, it was found impossible to devote sufficient time and attention btain a complete series of comparative analyses of the milk yielded the cows on the different foods. Still, sufficient has been done rly to indicate the comparative characters of the different milks.

able XVII (p. 52) shows the percentage of total solids, in 13 ples of the *morning* milk, of each of the two lots of cows, taken tervals during the 10 weeks from January 14 to March 25; Lot 1 ing silage, and Lot 2 mangels containing a corresponding amount lry matter; each lot having the same amount of other foods in ition. The table also shows the percentages of mineral matter, or in the last eight samples for each lot.

TABLE XVII.—PERCENTAGES OF TOTAL SOLIDS, AND MINERAL MATTER (ASH), IN THE MORNING MILK OF THE COWS.

Lot 1.—*Silage.* Lot 2.—*Mangels.*

Dates.	Total solids.		Mineral matter (ash).	
	Lot 1. Silage.	Lot 2. Mangels.	Lot 1. Silage.	Lot 2. Mangels.
A.M.	Per cent.	Per cent.	Per cent.	Per cent.
January 14	12·13	12·36	—	—
„ 19	12·01	12·12	—	—
„ 21	11·96	12·35	—	—
„ 26	11·95	12·05	—	—
„ 28	11·80	12·30	—	—
February 9	11·86	12·19	0·75	0·78
„ 11	11·87	12·15	0·79	0·77
„ 23	11·92	12·15	0·61	0·65
„ 25	11·77	12·12	0·72	0·72
March 9	11·94	12·21	0·71	0·72
„ 11	11·91	12·36	0·71	0·73
„ 23	11·93	12·52	0·73	0·73
„ 25	12·02	12·68	0·71	0·73
Mean	11·93	12·27	0·72	0·73

Table XVIII (p. 53) shows, not only the percentages of total solids and of mineral matter, but also the percentages of butter-fat, and the specific gravity, of both the *morning* and the *evening* milk of each lot of cows, on six different days from April 7 to April 22. It may be stated that the percentage of fat was frequently determined by Marchand's lacto-butyrometer; but the results given in the table are calculated by Fleischmann and Morgen's formula, from the amount of total solids, and the specific gravity. The results obtained by the lacto-butyrometer, although very useful, are admittedly only approximative; and, as Dr. P. Vieth has shown by a very comprehensive investigation of the subject, the deviations from the amounts as determined by more exact methods, are greater in the case of results obtained by it, than in those obtained by calculation from the total solids and the specific gravity.

Referring to the results in Table XVII, it should be observed that Lot 1 were receiving clover-silage during the periods of sampling from January 14 to March 11, and a mixture of clover-silage and meadow-grass-silage when the samples of March 23 and March 25 were taken. They were also receiving meadow-grass-silage at the six periods of sampling to which the results given in Table XVIII refer. Lot 2, however, received mangels throughout.

TABLE XVIII.—COMPOSITION OF THE MORNING AND THE EVENING MILK OF THE COWS.

Lot 1.—*Meadow-grass-silage.* Lot 2.—*Mangels.*

Dates.	Average yield of milk per head.			Specific gravity of the milk (corrected to 60° F.).			Total solids.			Butter-fat.			Mineral matter (ash).		
	A.M.	P.M.	Total.	A.M.	P.M.	Direct daily average.	A.M.	P.M.	Direct daily average.	A.M.	P.M.	Direct daily average.	A.M.	P.M.	Direct daily average.
Lot 1.—*Meadow-grass-silage.*															
	lbs. oz.	lbs. oz.	lbs. oz.	Sp. gr.	Sp. gr.	Sp. gr.	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.	P. cent.
April 7....	14 4	10 0	24 4	1·0333	1·0321	1·0328	12·29	12·67	12·45	3·03	3·61	3·27	0·71	0·71	0·71
„ 9....	13 6	9 2	22 8	1·0331	1·0328	1·0330	12·41	13·06	12·67	3·18	3·78	3·42	0·73	0·71	0·72
„ 13....	14 6	10 0	24 6	1·0331	1·0320	1·0326	12·18	12·68	12·39	2·99	3·64	3·26	0·70	0·73	0·71
„ 15....	15 9	10 12	26 5	1·0334	1·0325	1·0330	11·97	12·79	12·31	2·74	3·62	3·10	0·73	0·72	0·73
„ 20....	15 6	10 11	26 1	1·0322	1·0324	1·0323	11·82	12·79	12·22	2·86	3·64	3·18	0·64	0·71	0·67
„ 22....	15 15	10 10	26 9	1·0325	1·0323	1·0324	12·09	12·64	12·31	3·02	3·54	3·23	0·71	0·70	0·71
Mean ..	14 13	10 3	25 0	1·0329	1·0324	1·0327	12·13	12·77	12·39	2·97	3·64	3·24	0·70	0·71	0·71
Lot 2.—*Mangels.*															
April 7....	14 13	11 1	25 14	1·0335	1·0339	1·0337	12·99	13·54	13·23	3·58	3·96	3·74	0·75	0·76	0·75
„ 9....	15 1	10 12	25 13	1·0344	1·0338	1·0341	12·85	13·43	13·09	3·26	3·89	3·52	0·75	0·73	0·74
„ 13....	14 11	10 13	25 8	1·0345	1·0339	1·0342	12·54	13·40	12·90	2·99	3·84	3·35	0·73	0·74	0·73
„ 15....	15 0	10 11	25 11	1·0344	1·0343	1·0344	12·64	13·49	12·99	3·08	3·82	3·39	0·74	0·76	0·75
„ 20....	16 5	11 12	28 1	1·0340	1·0339	1·0339	12·14	13·53	12·72	2·74	3·95	3·25	0·64	0·75	0·69
„ 22....	16 0	11 12	27 12	1·0341	1·0340	1·0341	12·73	13·39	13·01	3·22	3·81	3·47	0·74	0·74	0·74
Mean ..	15 5	11 2	26 7	1·0341	1·0340	1·0341	12·65	13·46	12·99	3·15	3·88	3·45	0·72	0·75	0·73

It is seen that the mean percentage of total solids in the 13 samples of the morning milk of the silage-fed cows, taken from January 14 to March 25, is 11·93 against 12·13, the mean of the six samples of their morning milk taken from April 7 to April 22. Again, the mean of the 13 samples of the morning milk of the mangel-fed cows, taken from January 14 to March 25, was 12·27, against 12·65 during the period from April 7 to April 22. There was thus, in both cases, an increase in the percentage of total solids as the season advanced. But, as the increase was even greater with the mangel- than with the silage-fed cows, it is obvious that the result is due to the season, and not, in the case of Lot 1, to the change from clover- to meadow-grass-silage.

Still confining attention to the results relating to the morning milk, which is well known to be poorer than evening milk, it is seen that at each of the 19 periods of sampling to which Tables XVII and XVIII refer, the milk of the mangel-fed cows shows a higher percentage of total solids than that of the silage-fed cows. It also shows, almost without exception, a slightly higher percentage of mineral matter.

Turning now to the more detailed composition, as recorded in Table XVIII, it is seen that the milk of both lots shows, on the average, indeed in nearly every individual case, a slightly lower specific gravity in the afternoon than in the morning. The afternoon milk shows, on the other hand, uniformly a considerably higher percentage of both total solids and butter-fat; and generally a somewhat higher percentage of mineral matter also. Thus, whilst the mean percentage of total solids in the morning milk of the silage-fed cows is 12·13, in their evening milk it is 12·77, or 0·64 higher; and whilst the mean percentage of total solids is 12·65 in the morning milk of the mangel-fed cows, it is 13·46, or 0·81 higher, in their evening milk. Again, whilst the mean percentage of butter-fat in the morning milk of the silage-fed cows is 2·97, in their evening milk it is 3·64, or 0·67 higher; and whilst the mean percentage of butter-fat in the morning milk of the mangel-fed cows is 3·15, in their evening milk it is 3·88, or 0·73 higher. It is thus seen that, in the case of both lots of cows, the higher percentage of total solids in the evening milk very closely corresponds with the increased amount of butter-fat in the evening milk.

The first three columns of Table XVIII, show the average yield of milk per head of each lot of cows, in the morning, in the evening, and for the whole day, at each of the six periods of the sampling and the analysis of the milk. It will be seen that there was little more than two-thirds as much of the richer evening milk as of the poorer morning milk.

The "*direct daily averages*," of specific gravity, and of the percentages of total solids, butter-fat, and mineral matter, as given in the

third column of the respective divisions of the table, are calculated from the quantities, and the composition, of the morning and the evening milk, respectively. According to these results, the average percentage of total solids in the total daily milk of the silage-fed cows was, over the six periods, 12·39, against 12·99, or 0·60 higher, in that of the mangel-fed cows. And the average percentage of butter-fat in the daily milk of the silage-fed cows is 3·24, against 3·45, or 0·21 higher, in the milk of the mangel-fed cows. There is thus less difference between the average amount of total solids in the milk of the two lots of cows, than there is between the morning and evening milk of the same cows; and there is very much less difference in the average amount of butter-fat in the milk of the two lots, than there is between the amount in the morning and the evening milk of the same cows. It may be added that the average percentages of total solids, and of butter-fat, agree very fairly with those given by Dr. Vieth for the average milk of the same period of the year; those of the silage-fed cows being somewhat below, and those of the mangel-fed cows above his average.

Upon the whole, the analytical results clearly show that the milk of the mangel-fed cows throughout contained higher amounts of both total solids, and butter-fat, than that of the silage-fed cows. Yet, quite consistently with the observation of others on the same point, the milk of our silage-fed cows was judged, both by colour and by taste, to be richer than that of the mangel-fed cows. The milk of the silage-fed cows possessed a slight, but not at all disagreeable, flavour, which may be described as *hayey*, and which could readily be detected by some, but not by others. The butter from the milk of the silage-fed cows was also much yellower than that from the milk of the mangel-fed cows; but there was no perceptible distinction between the two as to taste.

With these results we close the record of our silage experiments for the present.

Summary, and General Conclusions.

1. It would require a larger area of land to obtain a given quantity of dry substance of food in crops grown for ensilaging, than to obtain the same quantity in roots.

2. The substitution of ensilage-crops for roots on a large scale would necessitate a considerable change in the course of cropping. It would lessen the area under cleaning crops, and consequently lessen the area suitable for growing grain for the market.

3. Where ensilaging is only adopted instead of hay-making, it is improbable that it will be substituted for it entirely, and if only

partially, the process would only have a comparatively limited application. Or, if it be extended to the natural and artificial grasses usually fed on the land, an expensive mode of feeding would be substituted for an economical one.

4. Neither in the case of red-clover, nor in that of meadow-grass, was the loss of dry substance of food in the silo so great as has frequently been supposed. It was, so far as can be judged, much about the same as in a hay rick.

5. There was some total loss of nitrogenous substance; but there was a much larger amount of it degraded from the albuminoid condition to compounds incapable of forming the nitrogenous substances of animal increase, or of milk.

6. The results obtained do not confirm the conclusion that woody fibre of a given degree of induration is rendered more soluble, and consequently more digestible.

7. In a comparative experiment with fattening oxen, a given amount of dry substance in red-clover-silage was found to be practically equal to the same amount of dry substance in a mixture of clover-hay-chaff and swedes, given in the proportion of 12 parts chaff and 50 parts swedes.

8. The amount of dry substance of food required by a cow of say about 1200 lbs. live-weight, when in milk, will vary considerably according to the character of the food, the temperature to which the animal is exposed, its yield of milk, and other circumstances. But it will seldom be less than 25 lbs. per head per day, and will seldom exceed 30 lbs.

9. When a milking cow is supplied with fair proportions of chaff and roots, with fair proportions of purchased food, such as cake and bran, in addition, the home-grown food will approximately supply the requirements of the animal for mere sustenance, and approximately the whole of the purchased food will remain for milk production. It is a question for consideration, therefore, how far the supply of the purchased foods should be graduated according to the yield of milk of each individual cow.

10. In ordinary liberal feeding, food is always consumed in excess of the amount which, according to calculation, is actually required for sustenance, and for the production of fattening increase, or of milk.

11. Two or three times as much total dry substance, and six, seven, or more times, as much nitrogenous substance, will be contained in the milk of a cow yielding 3 gallons per day, as in the fattening increase of an ox of the same weight.

12. In a comparative experiment with milking cows, clover-silage was tried against mangels. Two lots of cows, of 20 each, had the same amounts of cake, bran, and chaff; one lot receiving besides, an

average of nearly 49 lbs. of clover-silage, and the other lot an average of nearly 86 lbs. of mangels per head per day. Over a period of 13 weeks, the cows having clover-silage yielded an average of 25 lbs. 12 ozs. of milk per head per day, and those having mangels gave an average of 27 lbs. 5 ozs. per head per day.

13. There was more nitrogenous substance, and rather more total dry substance, but more of this was woody fibre, in the quantity of clover-silage consumed, than in the mangels. The silage was, therefore, when given in such large proportion, less suitable for milk-production than the more succulent mangels. The result was that the cows on the silage showed more tendency to fatten; and, in fact, though giving less milk, they gained in live-weight, whilst the mangel-fed cows slightly lost in weight.

14. It is probable that, if a portion of the clover-silage had been replaced by an amount of mangels containing a corresponding quantity of dry matter, the yield of milk would have been greater, and the tendency to increase in live-weight would have been less.

15. In a second experiment with the two lots of cows of 20 each, and extending over six weeks, the same standard foods were given as before; but, in addition, the one lot now received meadow-grass-silage, and the other mangels as before. Compared with the clover-silage, the meadow-grass-silage would contain still more woody fibre, and it contained little more than two-thirds as much nitrogenous substance. It was accordingly found that the animals would not consume so much chaff, nor the whole of the silage given to them. Some mangels were therefore given with the silage, when they consumed it better. Both lots of cows slightly declined in yield of milk during this period, the silage-fed cows rather less than the others. There was, however, but little difference in the yield of the two lots; but whilst the silage-fed cows now lost in weight, the mangel-fed cows slightly gained.

16. When analysed, the milk of the mangel-fed cows invariably showed a higher percentage of both total solid matter, and butter-fat, than that of the silage-fed cows.

17. The afternoon milk of both lots of cows always gave higher percentages of both total solid matter, and butter-fat, than the morning milk; and the excess of solid matter in the afternoon milk very closely corresponded with its excess of fat.

18. There was more difference in the percentage of both total solid matter and fat, between the morning and the evening milk of the same lot of cows, than between the milk of the two lots taken at the same time of day.

19. There can be no doubt that good food may be preserved in a favourable state for future use by being properly ensilaged. But the

results obtained at Rothamsted do not favour the idea that produce which is itself not good food, can be made good food by being ensilaged.

20. Good ensilage, given in such amount as to supply the sam quantity of dry substance as would be given in chaff and roots, is no doubt a very good food for fattening oxen.

21. Good ensilage, given in less proportion, and in conjunction with roots, with the ordinary dry foods in addition, is no doubt a very good food for milking cows.

22. In conclusion, it is hoped that the details which have been given of the first year's experiments on ensilage at Rothamsted, will afford some useful basis for the consideration of those who may be deliberating whether or not to adopt the system.

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